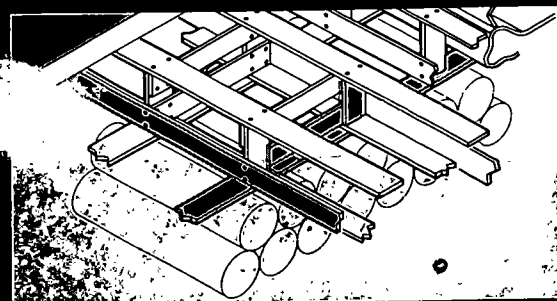
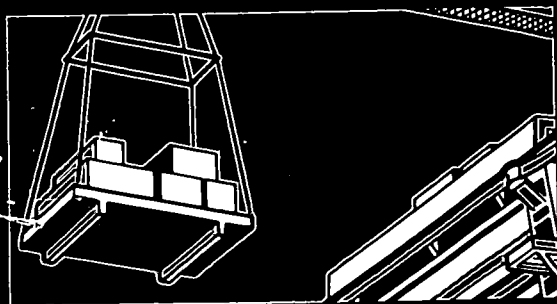
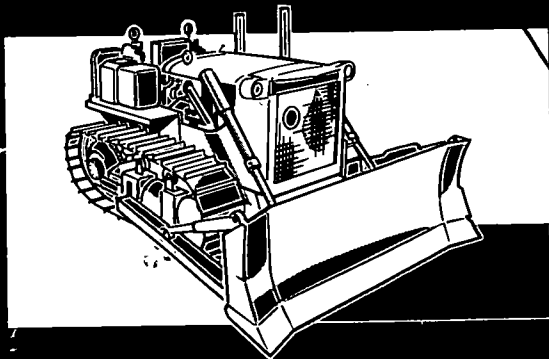
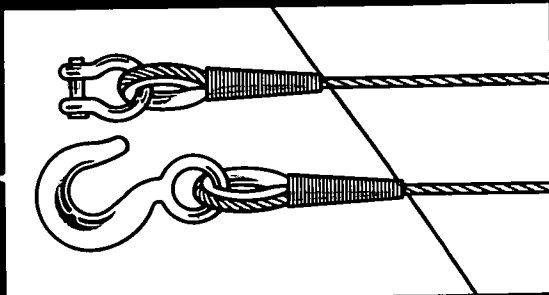
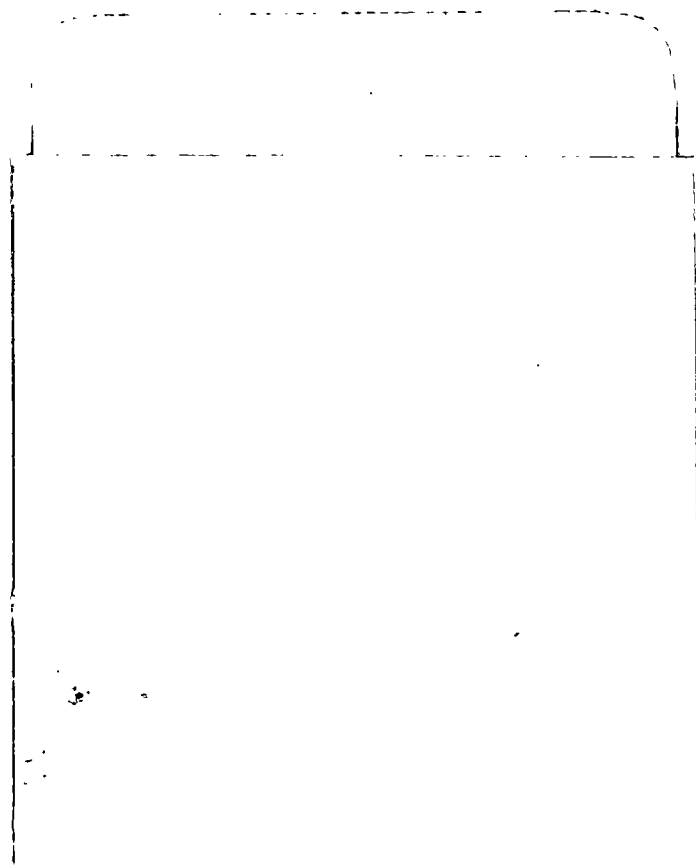


Copy 2
SK 9 Sep 1990

FIELD MANUAL
NUMBER 55-17



**TERMINAL
OPERATIONS
COORDINATOR'S
HANDBOOK**



Copy 2
SLK 9 Sep 1990

FIELD MANUAL
NO. 55-17

*FM 55-17
HEADQUARTERS
DEPARTMENT OF THE ARMY
Washington, DC, 18 July 1979

TERMINAL OPERATIONS COORDINATOR'S HANDBOOK

*This FM supersedes FM 55-16, 30 November 1973 and FM 55-17, 28 November 1975.

PREFACE

This manual sets forth the principles, doctrinal guidance, and important job duties of a terminal operations coordinator. It presents such duties in light of three types of terminal operation missions as follows:

COMPANY	MISSION
Terminal service company	Move breakbulk cargo
Terminal service company (containerized)	Move containerized cargo
Terminal transfer company	Transfer both breakbulk and containerized cargoes from one to another form of transportation.

It provides technical information and methods of operations for the captains, lieutenants, sergeants and enlisted personnel who are tasked with moving supplies and material to support the combat forces. Higher echelon guidance for commanders and staff officers concerned with the planning, organizing, and operation of Army terminal units can be found in FM's 55-50, 55-51, 55-60, and 55-70.

You are encouraged to recommend changes to this publication and submit comments for its improvement. Comments should be keyed to the specific page, paragraph, and line of the text in which the change is recommended, using DA Form 2028, and should be forwarded to:

Commandant
US Army Transportation School
ATTN: ATSP-TD-LIT
Fort Eustis, Virginia 23604

NOTE: Use of the masculine gender in this manual is intended to include both masculine and feminine genders.

CONTENTS

CHAPTER 1	HARBOR FACILITIES AND VESSELS	1-1
	HARBOR FACILITIES AND STRUCTURES	1-1
	VESSEL CLASSIFICATIONS	1-2
	GENERAL TYPES OF VESSELS	1-2
	TYPES OF VESSEL LOADING	1-5
	SHIPS' OFFICERS AND ARMY TRANSPORTATION PERSONNEL	1-5
	SHIPBOARD TERMINOLOGY	1-6
	SUMMARY	1-6
CHAPTER 2	CARGO HANDLING GEAR	2-1
	GENERAL PURPOSE GEAR	2-1
	SPECIAL PURPOSE GEAR	2-6
	CARGO HANDLING AIDS	2-12
	CARE OF CARGO HANDLING GEAR	2-13
	SAFETY PRECAUTIONS	2-13
	SUMMARY	2-14
CHAPTER 3	MATERIAL HANDLING EQUIPMENT	3-1
	FORKLIFT TRUCKS	3-1
	TRACTORS, TRAILERS, AND HANDTRUCKS	3-3
	PALLET JACKS	3-4
	CRANES	3-5
	SUMMARY	3-6
CHAPTER 4	RIGGING AND OPERATING SHIP'S	
	CARGO HANDLING GEAR	4-1
	SHIP'S CARGO HANDLING GEAR AND EQUIPMENT	4-1
	RIGGING STANDARD CARGO BOOMS	4-9
	THREE STANDARD CARGO BOOM RIGS	4-13
	RIGGING STANDARD BOOMS FOR HEAVY LIFTS	4-16
	RIGGING JUMBO BOOMS	4-22
	HATCH TENTS AND SAVE-ALL NETS	4-27
	NEW DEVELOPMENTS IN SHIP'S GEAR	4-29
	SUMMARY	4-31
CHAPTER 5	LOADING AND DISCHARGING	
	GENERAL CARGO VESSELS	5-1
	CARGO HOLD COMPARTMENTS	5-1
	GENERAL RULES FOR STOWING CARGO	5-8
	SECURING CARGO	5-9
	STOWING DIFFERENT TYPES OF CARGO	5-14
	DISCHARGING CARGO	5-24
	PREVENTING DAMAGE TO AND LOSS OF CARGO	5-26
	SUMMARY	5-29

CHAPTER 6	LOADING HAZARDOUS CARGO	6-1
	BASIC LOADING AND SECURING REQUIREMENTS	6-1
	THE SECURING PROCESS	6-6
	STANDARD SECURING STRUCTURES AND REQUIREMENTS	6-9
	SUMMARY	6-26
CHAPTER 7	CONTAINERIZED CARGO	7-1
	CONTAINER HANDLING EQUIPMENT	7-1
	MILITARY AND CIVILIAN WORKFORCE ORGANIZATION	7-4
	SELECTING ITEMS FOR CONTAINER TRANSPORT	7-6
	STUFFING CONTAINERS	7-6
	SECURING A CONTAINER	7-8
	LIFTING A CONTAINER	7-9
	SUMMARY	7-11
CHAPTER 8	SPECIAL CARGO HANDLING OPERATIONS	8-1
	LOGISTICS OVER THE SHORE (LOTS) OPERATIONS	8-1
	LASH AND SEABEE OPERATIONS	8-6
	ROLL-ON/ROLL-OFF OPERATIONS	8-17
	SUMMARY	8-19
CHAPTER 9	MARKING AND TALLYING CARGO	9-1
	ADDRESS MARKINGS	9-1
	SPECIAL MARKINGS	9-5
	TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT	9-8
	CARGO TALLYING METHODS	9-15
	TALLYING BREAKBULK CARGO	9-18
	TALLYING CONTAINERS	9-20
	SUMMARY	9-21
CHAPTER 10	SAFETY IN TERMINAL OPERATIONS	10-1
	VESSEL ACCESS	10-1
	OPENING AND CLOSING HATCHES	10-3
	VESSEL WORKING SURFACE	10-4
	SHIP'S GEAR	10-6
	HANDLING CARGO	10-17
	GENERAL WORKING CONDITIONS	10-20
	SUMMARY	10-22
CHAPTER 11	TRANSFERRING BREAKBULK AND CONTAINERIZED CARGO	11-1
	ORGANIZATION	11-1
	MISSION	11-1
	ASSIGNMENTS	11-2
	SUMMARY	11-2

APPENDIX A	REFERENCES	A-1
APPENDIX B	FORMULAS	B-1
APPENDIX C	ABBREVIATIONS	C-1
APPENDIX D	KNOTS, BENDS, AND HITCHES	D-1
APPENDIX E	GLOSSARY	E-1
APPENDIX F	CONVERSION FACTORS	F-1
APPENDIX G	CARGO SHIPS AND ARMY LIGHTERS	G-1
APPENDIX H	WARNING LABELS	H-1
	INDEX	I-1



13
14

15
16



17
18

19

20

21

22



CHAPTER 1 HARBOR FACILITIES AND VESSELS

Before we begin our discussion of terminal tasks, it will be very useful for you to learn something about harbor facilities and the types of cargo ships you will probably encounter. It is also important that you have some understanding about the relationship that exists between Army transportation personnel and various ship's officers.

HARBOR FACILITIES AND STRUCTURES

The following terms are used to describe harbor facilities and structures.

ANCHORAGE—An area in a harbor or stream where a vessel anchors.

APRON—That portion of a wharf, pier, or quay lying between the waterfront edge and the transit shed.

BERTH—The area assigned to a vessel in port when anchored or when lying alongside a quay or a pier.

SLIP—The area of water between two piers.

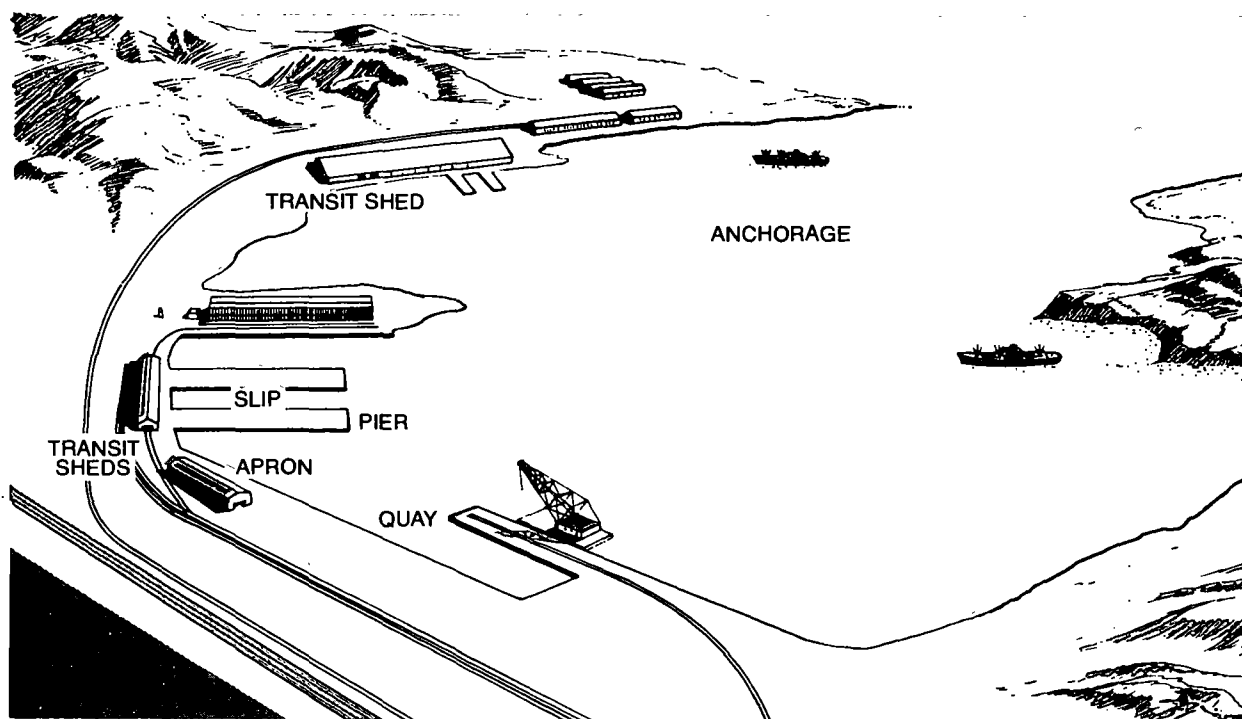
TRANSIT SHEDS—Structures built on piers or next to quays. They are used for the temporary storage of cargo in transit between a vessel

and an inland mode or storage area. Transit sheds are also used when covered protection is required and may be used for consolidating shipment units or for breakbulk shipments.

WHARF—A structure where ships moor or tie up. It is also the common name for two other such structures:

PIER—A wharf which runs out into the water and has berthing accommodations on both sides. Piers are sometimes L-shaped or T-shaped. This increases the number of sides available for berthing.

QUAY—(pronounced KEY) A wharf which parallels the shore and has berthing accommodations on one side only.



VESSEL CLASSIFICATIONS

The US Maritime Administration has set up a system for classifying cargo and passenger vessels. The system is based on three groups of letters and numbers. An example of this would be C4-S-1a. The first group indicates the type of vessel, such as cargo, passenger, tanker, etc., and the vessel's approximate length. The second group indicates the type of propulsion machinery, the number of propellers, and the number of passengers the ship can carry. The third group is used to show whether the ship reflects the original design, or whether major modifications have been made.

According to this classification system, C4-S-1a would describe a vessel with the following general characteristics.

The first group, C4, identifies the vessel as a cargo vessel having a length at the waterline of between 500 to 550 feet when fully loaded.

The S means that the vessel is equipped with steam propulsion machinery, has a single propeller, and carries no more than 12 passengers.

For this vessel, the 1a means that the ship was built to the original design and that it has not been modified since being built.

If major modifications had been made to the vessel, then its designation would be changed to reflect the modifications. If, for example, the vessel was modified to accommodate 50 passengers, its new designation would be C4-S1-1b. The C4 stays the same since it is still primarily a cargo ship, and its length is still between 500 and 550 feet. The original S becomes S1 to show that the vessel can carry more than 12 passengers. The 1a becomes 1b to show that this is the first major modification to the vessel. A complete listing of all ship classifications is shown in Appendix G.

GENERAL TYPES OF VESSELS

As we have seen, vessels are classified according to the service for which they were designed—carrying passengers, cargo, or any combination of passengers and cargo. The Army is concerned only with cargo vessels.

Since cargo vessels are built to fit the transportation needs of the trade, route, or service in which they are to be primarily engaged, there are many types and classes. In terms of the type

of cargo carried, there are two general types: liquid cargo ships and dry cargo ships. Liquid cargo vessels (bulk tankers) carry petroleum products, water, chemicals, and other liquids. Dry cargo vessels primarily transport all commodities not included in the liquid classification. They can carry liquids if the liquids are in containers such as tanks, drums, or kegs.

LIQUID CARGO VESSELS

Cargo shipped by liquid cargo vessels is pumped directly from the vessel into storage tanks which are maintained by the Quartermaster Corps. Since the Quartermaster Corps

also has the discharge responsibility of liquid cargo vessels, we will not discuss this type of ship further in this manual.

DRY CARGO VESSELS

Dry cargo vessels include general cargo, bulk cargo, and refrigerated cargo vessels. There are several types of dry cargo vessels you will be likely to encounter, and which we shall describe here very briefly.

C1 VESSEL

The C1 is the smallest of the C-class vessels. Because of its small cargo capacity and limited speed, the C1 sees little use today except in short run or coastal operations.

C2 VESSEL

At one time, the C2 was one of the most widely used vessels for transporting general cargo. Although it is still likely to be encountered in one of several variations, it is gradually being phased out in favor of larger and faster ships.

C3 VESSEL

The C3 cargo vessel is the type most widely used by US shipping companies. It has about 40 percent more cargo space than the C2 which makes it more economical for use in shipping large cargoes in worldwide operations. There are many basic variations of this vessel.

C4 VESSEL

The C4 has a slightly larger cargo capacity than the C3. Its primary advantages over the C3 vessel are in its higher rate of speed and in the

many built-in devices and features that aid in loading and unloading, which cuts down on time spent at the wharf. There are over 10 basic types of C4 vessel.

C5 VESSEL

The C5 vessels are the largest general cargo vessels in use by US shipping companies today. One version, the C5-S-78a, can be loaded or unloaded by rolling cargo on or off through doors in the side and the stern in addition to using cargo booms. Because of this, the ship can be loaded or unloaded in a single day as opposed to the three or more days it typically takes to unload a C4 or smaller class ship.

C6 VESSEL

All C6 vessels are container ships; that is, all cargo is carried in standard 8- by 8- by 20-foot containers.

C7 VESSEL

The C7 vessels are also container ships. One design within the C7 type, the C7-S-68, is the largest container ship in the world. It can carry over 1200 standard containers.

Upper left:

The SS *Delta Brasil* (C3-S-76a)

Lower left:

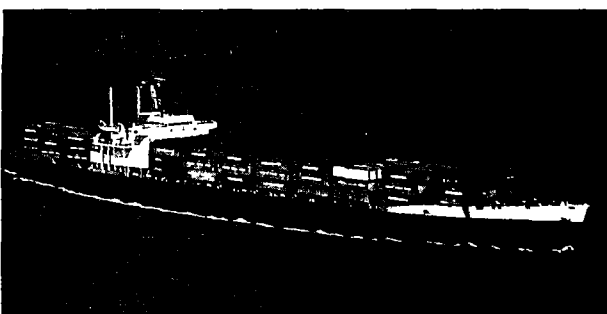
The SS *Frederick Lykes* (C4-S-66a)

Upper right:

The SS *Alaskan Mail* (C5-S-75a)

Lower right:

The SS *American Astronaut* (C7-S-68)



C8 VESSEL

The C8 vessels are the largest cargo vessels in the world. They are designed primarily to carry loaded lighters or barges. Because of this, they need not be tied up to a wharf to unload. Instead, they lower the loaded barges into the water with built-in elevators and the barges are brought to shore for unloading.

Three additional types of vessels you will be likely to encounter are the Roll-on/Roll-off (RORO) vessel, the SEATRAIN, and heavy lift vessels. Although ships of these types have been

Upper left:

The SS *Puerto Rico* (SEATRAIN)

Lower left:

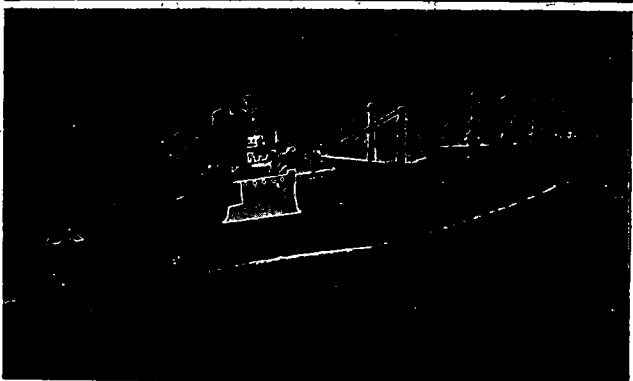
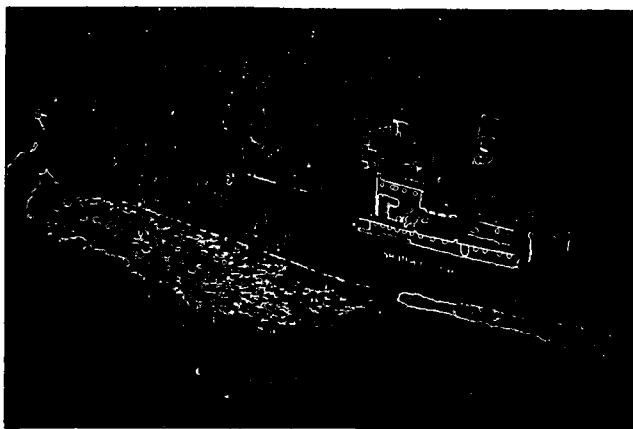
The GTS *Wm. F. Callaghan* (RORO)

Upper right:

LASH (C8-S-81a) Test basin model

Lower right:

The SS *Transcolorado* (Heavy Lift)



in service for some years, no C-class designation has been assigned to them.

RORO VESSEL

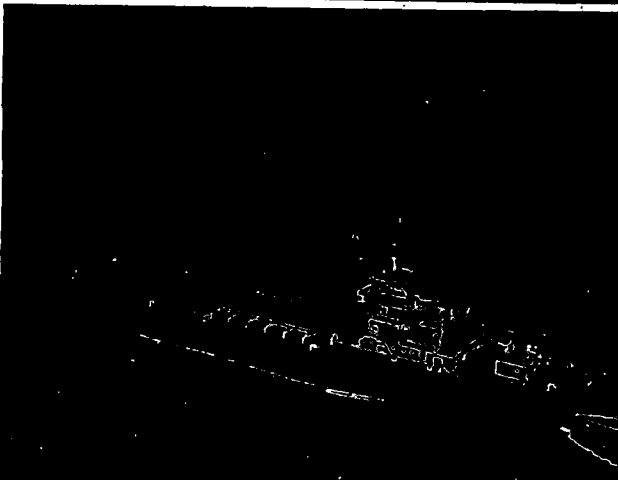
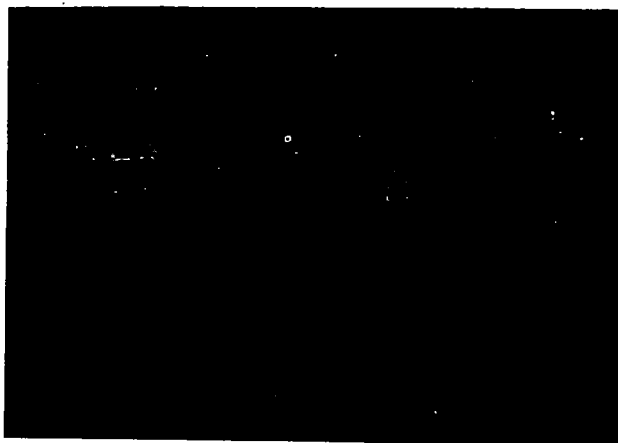
RORO vessels were specifically designed to accommodate roll-on/roll-off cargo. They feature side access and stern ramps.

SEATRAIN VESSEL

SEATRAINS are converted tankers specifically modified to transport vehicles, containers, and odd or oversized cargoes such as airplanes.

HEAVY LIFT VESSEL

Heavy lift ships are converted C4 types with special cargo handling equipment installed that allow them to load or unload cargo items weighing up to 240 tons.



TYPES OF VESSEL LOADING

The order in which cargo is loaded determines the order in which supplies and equipment will be discharged. The cargo planner must be able to load a vessel so that it can be discharged to

meet the requirements of any given mission. There are two general types of vessel loading: administrative and combat.

ADMINISTRATIVE LOADING

Administrative loading is used in a noncombat situation. It makes maximum use of a ship's cargo-carrying capability. In administrative loading, equipment and supplies are discharged and sorted before they can be used. Since the majority of vessels are administratively loaded, this is the primary type of loading which will be discussed in this manual. Cargo loaded administratively is loaded for either a single port or multiple ports of discharge.

In loading for a single port of discharge, the

supplies are stowed so as to make maximum use of the carrying capacity of a ship.

In loading vessels for multiple-port discharge, supplies for more than one destination are stowed so that items can be discharged in the order of arrival at the ship's scheduled port of discharge. Care must be taken by the original and intermediate loading ports to prevent stowing cargo on top of other cargo that will be discharged sooner.

COMBAT LOADING

Combat loading is used during wartime to allow for quick and efficient unloading of troops, equipment, and supplies. This type of loading is not intended to make best use of all a vessel's space. Rather, combat loading is the type of loading that cargo load planners are primarily concerned with in amphibious operations.

Information on methods of combat loading and stowage for amphibious operations is found in FM 20-12.

SHIP'S OFFICERS AND ARMY TRANSPORTATION PERSONNEL

Coordination between Army transportation personnel and ship's officers is important in any terminal operation. As terminal operations coordinators, it is a good idea for you to become acquainted with the ship's captain and chief mate. Many problems in handling, stowing, and securing cargo can be readily taken care of by coordination with the chief mate, who is the ship's cargo officer.

In every case, the master of the vessel is completely responsible for the safe transportation of the cargo. He insures that the stowage will not

adversely affect the cargo or the safety or seaworthiness of his vessel. Prestowage plans are presented to the Military Sealift Command (MSC) for approval. Upon arrival of the vessel, the plans are submitted to the master or his designated representative for final approval. The cargo holds and ship's gear are inspected jointly to see whether there will be any difficulty in carrying out the loading according to the prestowage plan. If inspection reveals that the plan is not possible, changes must then be made and approved by the master before cargo loading begins.

SHIPBOARD TERMINOLOGY

In order to function aboard ship, it is important that you know basic ship terminology. Study some of the common terms used for location, position, and direction aboard ship, understand them thoroughly, and use them correctly.

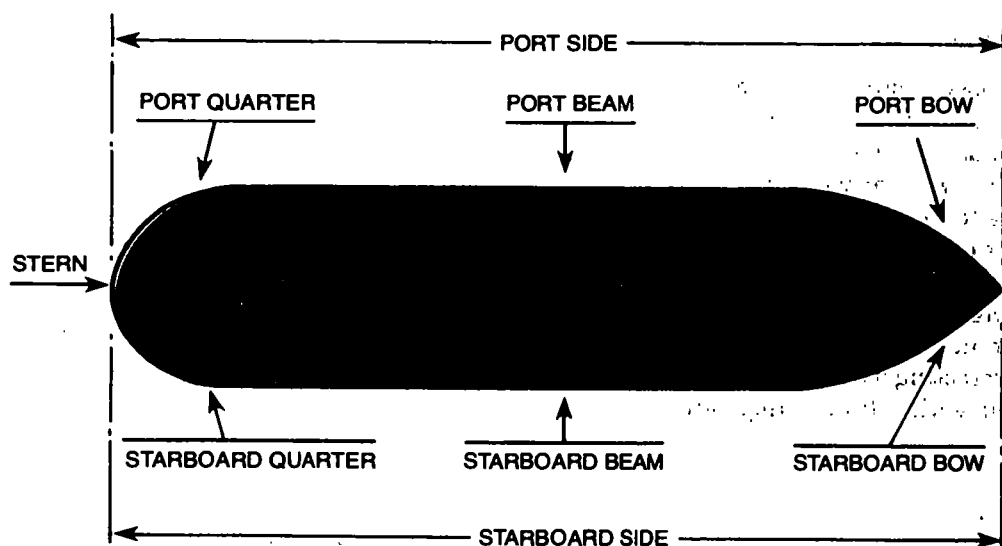
The front end of a ship is the *bow*. When you move toward the bow you are going *forward* and when the vessel is moving forward, it is going *ahead*. When facing toward the bow, the front-right side is called *starboard* and the front-left side is called *port*.

The central or middle area of a ship is *amidships*. The right-center side is the *starboard beam*, and the left-center side is the *port beam*.

The rear of a vessel is the *stern*. When you move in that direction, you are going *astern*; when the ship moves in that direction, it is going *astern*. When looking forward, the right-rear section is called the *starboard quarter*, and the left-rear section is called the *port quarter*.

The entire right side of a vessel from bow to stern is the *starboard side* and the left side is the *port side*. A line, or anything else, running parallel to the length of the vessel is said to be *fore and aft* and its counterpart, running from side to side, is *athwartship*.

From the centerline of the ship toward either port or starboard side is *outboard* and either side toward the centerline is *inboard*. However, there is a variation in the use of outboard and inboard when a ship is on *berth*, that is, moored to a pier. The side *against the pier* is referred to as being inboard; the side *away from the pier* is outboard. When you go down a *ladder*, you are going *below*. If you go up the ladder, you are going *above* unless you are headed for the upper deck which is going *topside*. If you were going higher, up into the rigging, you'd be going *aloft*. Now you can move around the vessel in any direction and properly describe your movements in the language of a seaman.



SUMMARY

We've talked about harbor facilities and different kinds of ships. We've discussed types of loading, and we've spoken briefly about the ship's

language. In the following chapters, we will talk much more about how you can use this knowledge to do your jobs better.

CHAPTER 2 CARGO HANDLING GEAR

Cargo handling gear consists of items used to secure cargo while it is being raised or lowered by the ship's gear. In addition, it moves cargo to and from its stowage position in the ship.

Proper selection and use of cargo handling gear is necessary for safe and efficient cargo operations. Personnel may use the wrong gear simply because of improper training. As terminal operations coordinator, you are responsible for overcoming this problem by properly training and supervising your personnel.

GENERAL PURPOSE GEAR

General purpose gear is used with many types of cargo. This type of gear includes the following:

- Endless slings
- Single slings
- Combination slings
- Chain slings
- Canvas slings

Before discussing slings, let's look at the devices at the ends of slings which make them more useful. The ends of slings are usually made up into eyes, either with or without thimbles. The eyes are made to fit on the cargo hook and to be attached to the drafts or loads of cargo. With eyes in its ends, a sling is joined to another sling, a hook or a ring, either directly or by using a shackle. Thimbles in the eyes further strengthen the sling by protecting it from sharp bends around pins, hooks, shackles, links, rings, and similar objects.



EYE SPLICE



THIMBLE IN EYE



LINK AND THIMBLE



SHACKLE AND THIMBLE



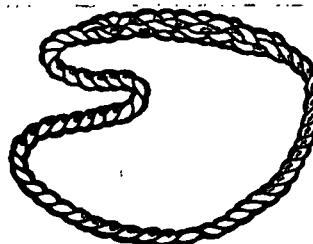
HOOK AND THIMBLE

SLING EYES

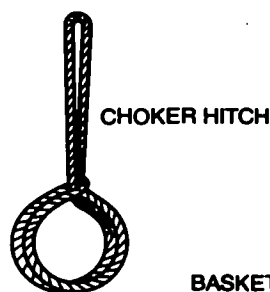
ENDLESS SLINGS

An endless sling is made by splicing the ends of a piece of wire or fiber rope together. It is simple to handle and is used in several different ways to lift loads. The endless sling is most commonly used as a choker hitch.

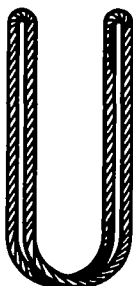
The endless sling, when used as a choker, is passed around the draft of cargo so that one end



ENDLESS SLING



BASKET HITCH

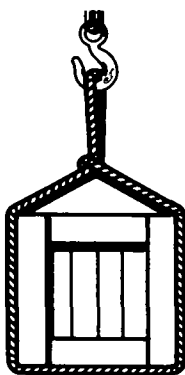


forms a loop on top of the draft. The other end is passed through this loop, pulled tight, and attached to the cargo hook.

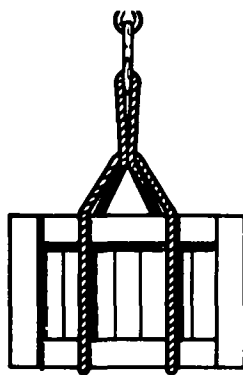
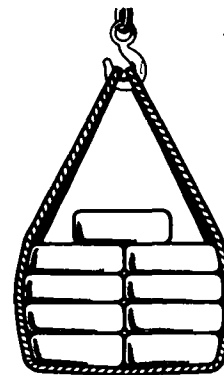
To balance the load, the two parts of the sling on the bottom of the draft are spread apart.

The endless sling is also used with chime or running hooks. It is used as a basket sling, an inverted basket, or a vertical sling.

Do not use endless slings to lift bagged cargo such as sugar, flour, and cement. They require canvas slings.



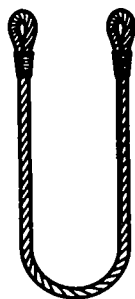
CHOKER HITCH

ENDLESS
CHAIN
SLING

BASKET HITCH

SINGLE SLINGS

A single sling is made of fiber or wire rope. Each end of the single sling is made up with an eye, a hook, a ring, or a thimble, depending upon the intended use of the sling. A single sling is used as a vertical sling, a basket sling, or a choker sling with a choker hitch.

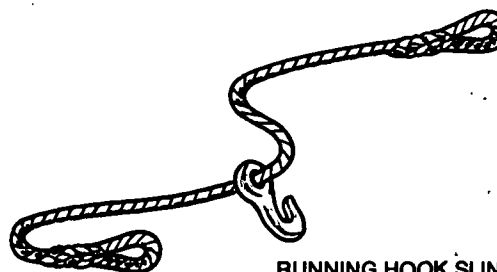


BASKET HITCH

CHOKER HITCH



variety of uses. They are made up in lengths ranging from 5 to 150 feet, or even longer for special cargo. Running hook wire rope slings may be



RUNNING HOOK SLING

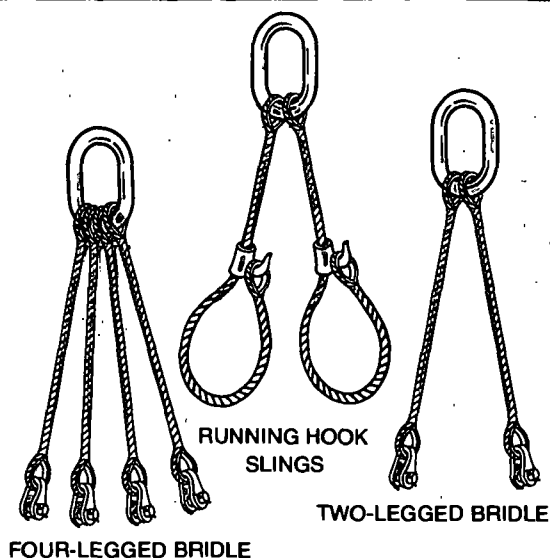
Single slings made of fiber rope are used for light loads and for cargo that might be damaged by wire slings. Those made of wire rope have a

used to hoist drafts of lumber, dunnage, iron pipe, building steel, strong boxes, and large cases. Each running hook sling is made with 18-inch eyes at each end. To use the sling, you wrap it around the draft, attach one eye to the sliding hook, and put the other eye on the cargo hook.

COMBINATION SLINGS

Combination slings consist of two or four single slings combined to form a bridle, basket, or choker sling to lift virtually any type of load. Be careful when fastening the bottoms of the sling legs to the draft. Do it in a way that does not damage the cargo. Sometimes lifting eyes fastened to the equipment at the time of manufacture help keep this from happening. Also, at times shackles and hooks can be joined to the eyes on the ends of the sling legs to handle heavy loads. When several slings are passed under large crates or boxes to form a basket sling, it may be advisable to use protective spreader bars to prevent crushing.

The following tables present safe working load ranges for wire rope, and for manila rope rigged at various angles. Notice that load capacities decrease as angles increase.



MANILA ROPE

(In pounds or tons of 2000 pounds)

Circumference (inches)	Diameter (inches)	Single Leg	60°	45°	30°
3/4	1/4	120 lbs	240 lbs	170 lbs	120 lbs
1	5/16	200	346	282	200
1 1/8	3/8	270	467	380	270
1 1/4	7/16	350	605	493	350
1 3/8	15/32	450	775	635	450
1 1/2	1/2	530	915	798	530
1 3/4	9/16	690	1190	973	690
2	5/8	880	1520	1240	880
2 1/4	3/4	1080	1870	1520	1080
2 1/2	13/16	1300	2250	1830	1300
2 3/4	7/8	1540	2660	2170	1540
3	1	1800	3120	2540	1800
3 1/4	1 1/16	1.0 tons	1.7 tons	1.4 tons	1.0 tons
3 1/2	1 1/8	1.2	2.1	1.7	1.2
3 3/4	1 1/4	1.35	2.3	1.9	1.35
4	1 5/16	1.5	2.6	2.1	1.5
4 1/2	1 1/2	1.8	3.1	2.5	1.8
5	1 5/8	2.25	3.9	3.2	2.25
5 1/2	1 3/4	2.6	4.5	3.7	2.6
6	2	3.1	5.4	4.4	3.1
6 1/2	2 1/8	3.6	6.2	5.1	3.6

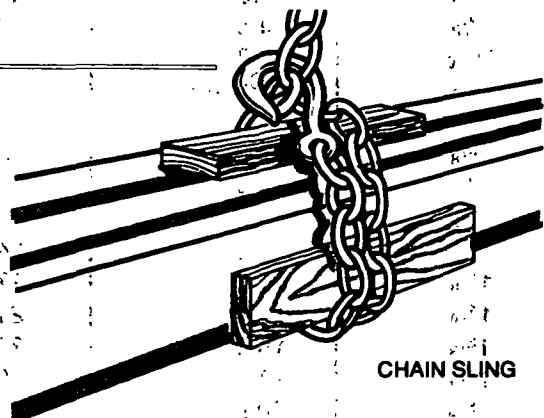
INDEPENDENT WIRE ROPE CORE, WIRE ROPE AND WIRE ROPE SLINGS
(In tons of 2000 pounds)

Rope Diameter (inches)	SINGLE LEG					
	Vertical			Choker		
	A	B	C	A	B	C
6 x 19 CLASSIFICATION						
1/4	0.59	0.56	0.53	0.44	0.42	0.40
3/8	1.3	1.2	1.1	0.98	0.93	0.86
1/2	2.3	2.2	2.0	1.7	1.6	1.5
5/8	3.6	3.4	3.0	2.7	2.5	2.2
3/4	5.1	4.9	4.2	3.8	3.6	3.1
7/8	6.9	6.6	5.5	5.2	4.9	4.1
1	9.0	8.5	7.2	6.7	6.4	5.4
1 1/8	11.0	10.0	9.0	8.5	7.8	6.8
6 x 37 CLASSIFICATION						
1 1/4	13.0	12.0	10.0	9.9	9.2	7.9
1 3/8	16.0	15.0	13.0	12.0	11.0	9.6
1 1/2	19.0	17.0	15.0	14.0	13.0	11.0
1 3/4	26.0	24.0	20.0	19.0	18.0	15.0
2	33.0	30.0	26.0	25.0	23.0	20.0
2 1/4	41.0	38.0	33.0	31.0	29.0	25.0
(A)—Socket or Swaged Terminal attachment. (B)—Mechanical Sleeve attachment. (C)—Hand Tucked Splice attachment.						

CHAIN SLINGS

Chain slings are made of standard links that must not be subject to loads greater than those shown in the following tables. Do not use a chain for lifting which shows evidence of having been stretched. Damage is shown by small cracks in the links, binding between links, or signs of stretching in the links.

Cargo handlers also use chain choker slings. Chain choker slings are used to handle such cargo as steel rails, pipes, and steel beams. Note that dunnage is placed to give the sling a better grip. The sling's links are wrought iron, which will stretch before it breaks, thus giving warning. Other types of iron may simply crystallize

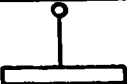


CHAIN SLING

and snap. You should make sure that chain slings are used carefully. Watch for warning signs such as stretching links, fracturing, and stretching hooks.

ALLOY STEEL CHAIN

(In tons of 2000 pounds)

Nominal Size Chain Stock (Inches)	Single Leg	60°	45°	30°
				
1/4	1.62	2.82	2.27	1.62
3/8	3.30	5.70	4.65	3.30
1/2	5.62	9.75	7.90	5.62
5/8	8.25	14.25	11.65	8.25
3/4	11.5	19.9	16.2	11.5
7/8	14.3	24.9	20.3	14.3
1	19.3	33.6	27.3	19.8
1 1/8	22.2	38.5	31.5	22.2
1 1/4	28.7	49.7	40.5	28.7
1 3/8	33.5	58.0	47.0	33.5
1 1/2	39.7	68.5	56.0	39.7
1 5/8	42.5	73.5	59.5	42.5
1 3/4	47.0	81.5	62.0	47.0

WROUGHT IRON CHAIN

(In pounds or tons of 2000 pounds)

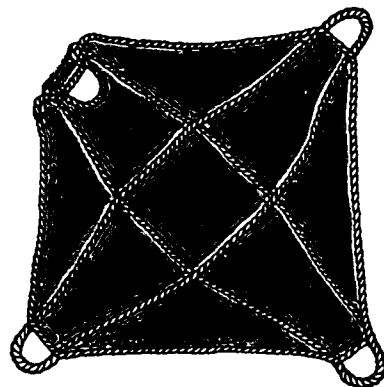
Nominal Size Chain Stock (Inches)	Single Leg	60°	45°	30°
				
* 1/4	1060 lbs	1835 lbs	1500 lbs	1060 lbs
* 5/16	1655	2865	2340	1655
3/8	2385	2.1 tons	3370	2385
* 7/16	3250	2.8	2.3 tons	3250
1/2	2.1 tons	3.7	3.0	2.1 tons
* 9/16	2.7	4.6	3.8	2.7
5/8	3.3	5.7	4.7	3.3
3/4	4.8	8.3	6.7	4.8
7/8	6.5	11.2	9.2	6.5
1	8.5	14.7	12.0	8.5
1 1/8	10.0	17.3	14.2	10.0
1 1/4	12.4	21.4	17.5	12.4
1 3/8	15.0	25.9	21.1	15.0
1 1/2	17.8	30.8	25.2	17.8
1 5/8	20.9	36.2	29.5	20.9
1 3/4	24.2	42.0	34.3	24.2
1 7/8	27.6	47.9	39.1	27.6
2	31.6	54.8	44.8	31.6

*These sizes of wrought iron chain are no longer manufactured in the United States.

CANVAS SLINGS

A canvas sling is a rope sling with a section of canvas sewn between the ropes. The main type of canvas sling in use is the dirt sling. In commercial practice, canvas slings similar to dirt slings are used for handling cargo such as nitrate.

CANVAS SLING



SPECIAL PURPOSE GEAR

Special purpose gear is made for use with certain types of cargo. It includes:

- Cargo nets
- Pie plates
- Pallets
- Spreaders
- Bridles
- Hooks
- Plate handling clamps.

CARGO NETS

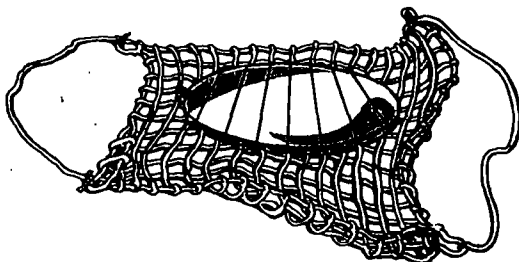
Cargo nets are usually made of manila rope, but nets of wire rope are used for special cargoes. Be careful not to crush cargo when using nets. The standard Army cargo net is 14 by 14 feet with a 7 $\frac{1}{2}$ -inch square mesh. The square meshes are made of 2 $\frac{1}{2}$ -inch circumference manila rope. The line around the circumference of the net is

made of 3-inch circumference manila rope.

Cargo nets are used to handle loose packages that are not all the same in size. The packages must be strong enough to withstand pressure. When making up a draft in a cargo net, stack the cargo so that the crushing effect of the net is kept to a minimum.

PIE PLATES

The crushing effect of a cargo net may be reduced by using a round "pie plate." This permits



PIE PLATE

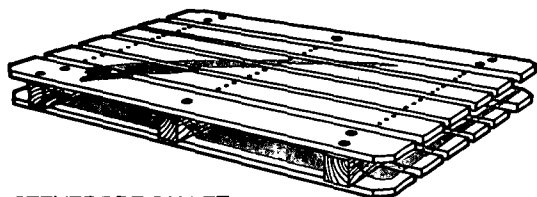
fragile cargo to be handled without damage. Pie plates are constructed of two layers of dunnage. They vary from 54 to 72 inches in diameter. You should place the pie plate in the center of the net and stack the cargo so that all the weight is on the pie plate.

If pie plates or pallets are not available, use cargo boards to reduce the crushing pressure of the cargo net. Cargo boards are constructed of two layers of dunnage nailed together to make a solid board 4 by 6 feet. The cargo board is placed in the center of the net, and is used in the same way as a pie plate.

PALLETS

The four basic types of pallets used in military cargo handling are the **stevedore**, **general purpose**, **sled**, and **warehouse** pallets.

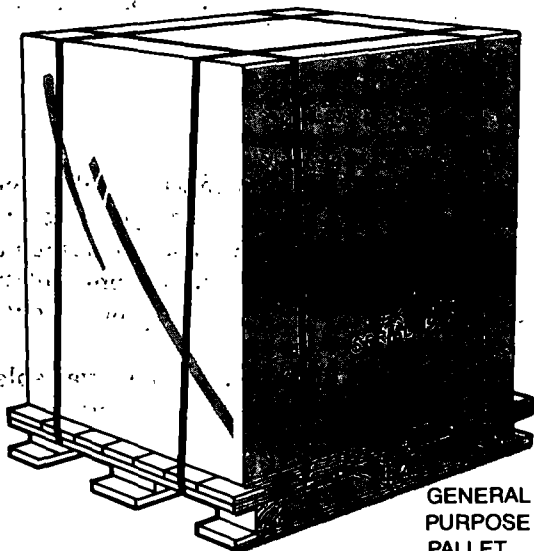
A **stevedore pallet**, which is reversible, is used to handle loose cargo at water terminals.



STEVEDORE PALLET

The standard stevedore pallet is 4 feet wide, 6 feet long, and 8 inches high. The stringers are made of 3- or 4- by 4-inch lumber. The deck boards are made of lumber 2 inches thick. The outside or end boards should not be less than 6 inches wide. The inside boards may be random widths. The outside stringers are set in 4 to 6 inches from the ends so that a pallet bridle may be inserted. The inside stringers are arranged to permit easy entrance of forks for movement by forklift trucks.

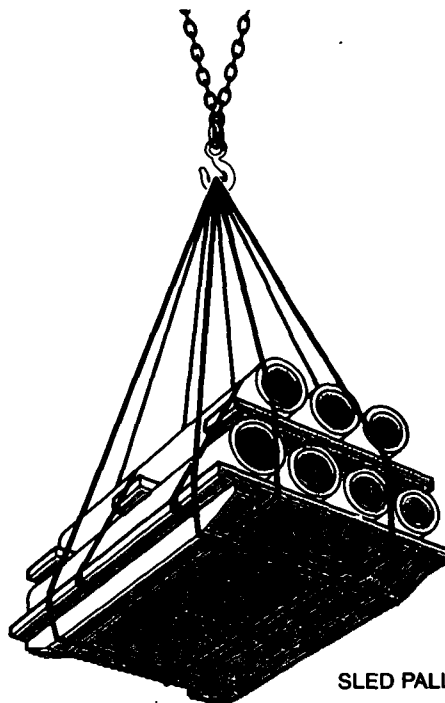
A **general purpose pallet** is a four-way-entry wood pallet, 48 inches long, 40 inches wide, and



GENERAL
PURPOSE
PALLET

approximately 5½ inches high. It is used mainly for the shipment of palletized cargo and often accompanies the cargo from shipper to consignee.

The **sled pallet** consists of a heavy timbered platform with runners. Supplies and equipment are normally banded to the pallet.



SLED PALLET

A **warehouse pallet** is used to handle cargo in warehouses. It is much lighter than the stevedore pallet. The most common size of warehouse pallet is 48 by 48 inches, but a 40 by 48-inch size is also made. The warehouse pallet can be the open end type that is moved by a forklift or hoisted by a pallet bridle, or the closed end type that is moved by forklift only.

When items of cargo are palletized, the tiers are laid in such a manner that one tier ties together with another to give stability to the unitized load and to keep the cargo from falling off the pallet while it is being moved from one place to another. Greater use of the pallet area is obtained by building the load in a definite pattern whenever possible.

SPREADERS

A spreader is any device used to keep the side pressure of the sling legs away from the load that is being hoisted. Some of the most commonly used spreaders are:

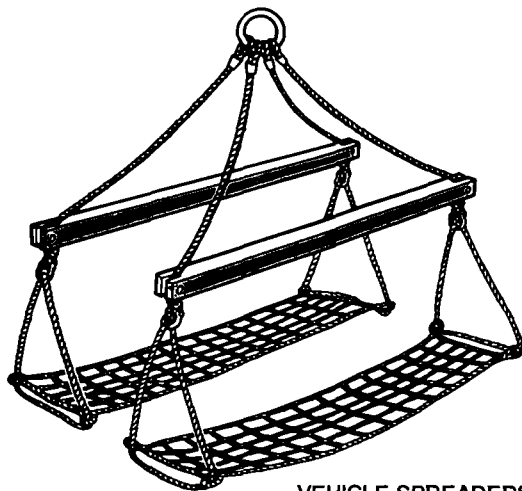
Vehicle spreader with wheel nets

Heavy lift spreader

Barrel sling spreader

Pallet bridle spreader.

A **vehicle spreader** is made of lengths of hardwood, pipe, or steel beams. It permits a straight pull on the sling and wheel nets. This keeps pressure away from the sides of the vehicle to be hoisted.



VEHICLE SPREADERS

Wheel nets are used for hoisting sedans and other light vehicles. The wheel nets included in the cargo set vehicle are 8 by 3 feet, with 6-inch mesh. Manila rope 3 inches in circumference is used in the net with the exception of the frame, where 3 $\frac{3}{4}$ -inch manila rope is used.

When using the sling and wheel net, the winch operator lowers the cargo hook until the wheel nets are on the ground. The nets are spread out in this position so there is enough clearance between the top of the cargo net and the bottom of the vehicle spreader to allow the vehicle to enter.

The vehicle is pushed until its wheels are in the net. Cargo handlers also use other types of slings to load vehicles. For example, a four-legged bridle can be used if the vehicle has been fitted with lifting eyes.

Heavy lift spreaders are made of steel beams, because stronger material is required to keep greater pressure away from the side of the heavy lift.

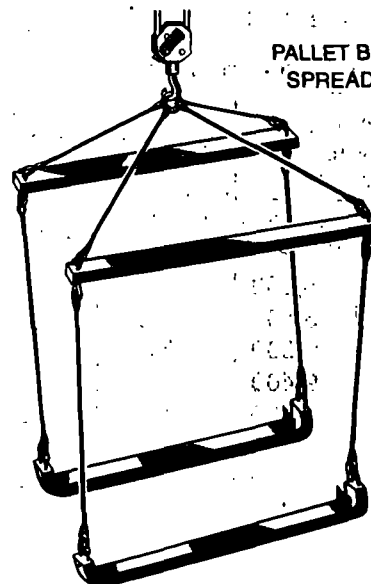
Barrel sling spreaders may be triangular, straight, or square. They are usually made of



BARREL SLING SPREADER

plate steel with holes for the shackles which hold the chime books. Hoisting a number of drums at one time is made possible with the use of the barrel sling spreader.

Pallet bridle spreaders keep pressure away from the sides of the draft. The straight type is made of steel or hardwood.

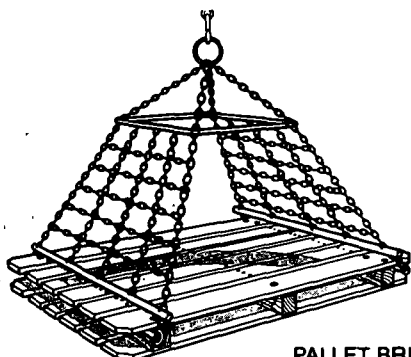


PALLET BRIDLE SPREADERS

BRIDLES

Bridles are lifting devices designed to hoist special types of cargo. They may be used in conjunction with spreaders. Listed below are the most common types of bridles.

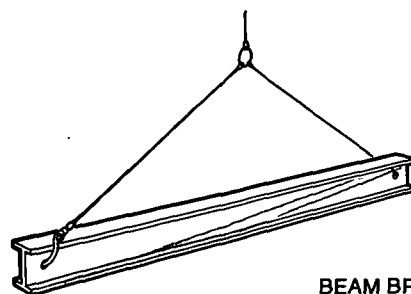
Pallet bridles are used for quick, efficient handling of palletized cargo. To use the bridles, insert the lifting bars at the bottom of the nets



PALLET BRIDLE

into the ends of the pallet. Spread the sling nets around the cargo as far as they will reach. Then, slip the eyes over the cargo hook. The bars at the top serve as spreaders.

Beam bridles are used to remove hatch beams from their sockets. The hooks are placed on opposite sides of the beam in the lightening holes



BEAM BRIDLE

or rings as provided. The beam will then ride level and straight up and down. Tag lines are attached to the bridles for control and safety.

Vehicle bridles are used for efficient handling of various types of vehicles. The size of the bridle depends on the size of the vehicle to be hoisted. Vehicle spreaders with wheel nets are used for passenger vehicles. Heavy lift spreaders are used for trucks.

Heavy duty bridles are used to reduce side pressure on heavy lifts. Bridles use a combination of wire rope, shackles, hooks, rings, and/or chain. It is important when using the bridles that you know the safe working load of this type of gear. The table below gives the recommended minimum size of shackles, chain, hooks, and rings to be used with various sizes of wire rope.

Recommended Minimum Sizes of Gear to be Used With Various Sizes of Wire Rope

Improved plow-steel 6 x 19 wire rope (hemp center)		New wrought- iron chain (diameter of stock in inches)	Round-pin or screw-pin shackle (diameter of pin in inches)		Drop-forged steel hooks (diameter in inches)		Steel rings and links (diameter of stock in inches)		
Diameter (inches)	Safe load (pounds)		Screw pin	Round pin	Eye	Throat	Circle	Oblong	Triangle
1/2	4,300	1/2	3/4	5/8	1 1/4	1 3/8	1	9/16	3/4
1/18	5,400	9/16	3/4	3/4	1 3/8	1 1/2	1 1/4	5/8	7/8
5/8	6,600	5/8	7/8	3/4	1 1/2	1 3/4	1 1/4	3/4	7/8
3/4	9,400	3/4	1	7/8	1 3/4	2	1 1/2	1	1
7/8	12,800	7/8	1 1/8	1	2 3/8	2 1/2	1 3/4	1 1/8	1 1/4
1	16,000	1	1 1/4	1 1/8	2 3/4	3	2	1 1/4	1 1/2
1 1/8	21,200	1 1/8	1 1/2	1 3/8	3 1/8	3 3/8	2 1/4	1 3/8	1 3/4
1 1/4	26,000	1 1/4	1 5/8	1 1/2	3 1/2	4	2 1/4	1 1/2	1 3/4
1 3/8	31,400	1 3/8	1 3/4	1 5/8	3 1/2	4	2 1/2	1 3/4	
1 1/2	37,000	1 1/2	2	2	4	4 1/2	2 3/4	1 3/4	2 1/4

HOOKS

Chains, fiber rope, or wire rope can be attached directly to the load. However, for speed and convenience, it is much better to fasten a hook to the cargo runner. The hooks most frequently used in cargo handling are **cargo hooks** and **hooks for slings**.

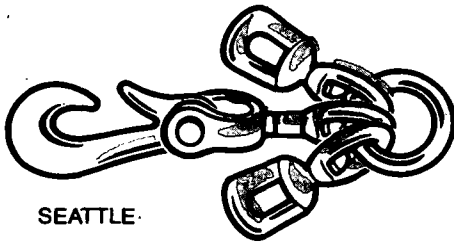
Cargo hooks are shackled to the cargo runners for lifting and lowering drafts of cargo. Three principal types are used on most ships; these are the **New York**, the **Liverpool**, and the **Seattle**.



NEW YORK



LIVERPOOL



SEATTLE

The **New York** cargo hook is a drop-forged, self-colored (natural colored) steel hook, fitted with a jaw-and-eye swivel.

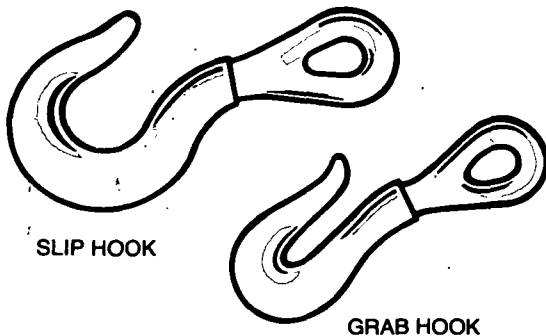
The **Liverpool** hook is a drop-forged, self-colored steel hook, fitted with a double-eye swivel. This hook is included in the general hatch set and has a safe working load of 11,200 pounds.

The **Seattle** cargo hook is a drop-forged, self-colored hook, fitted with one jaw-and-eye swivel, two double-eye swivels, and a ring. It may also have a double-eye swivel in lieu of the jaw-and-eye swivel. This hook is included in the general hatch cargo set. It has a safe working load of 11,200 pounds.

Hooks for slings can be used in a variety of ways. They can be shackled or spliced into an eye, placed on the sling before the eyes have been spliced to permit the hook to slide, or used with chain slings. The four general types of hooks available for slings are: the **slip** hook, the **grab** hook, the **box** hook, and the **chime** or **drum** hook.

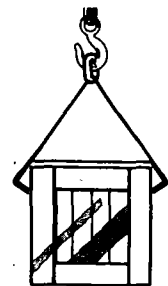
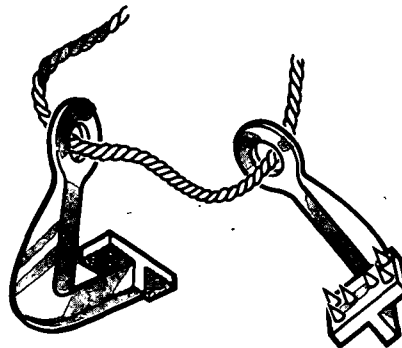
Slip hooks are so made that the inside curve of the hook is an arc of a circle. It may be used with wire rope, chains, and fiber rope. Chain links can move through a slip hook so the loop formed in the chain will tighten under a load.

Grab hooks have an inside curve which is nearly U-shaped so the hook will slip over a link of chain edgewise, but will not permit the next link to move through. Grab hooks have a more



SLIP HOOK

GRAB HOOK



BOX HOOKS

limited range of use than slip hooks. They are used when the loop formed with the hook is not intended to close up around the load.

Box hooks are heavy steel hooks with a studded steel plate on one end and an opening on the other end through which a sling can pass.

Box hooks are used in pairs and are attached to the sling in such a manner that the studded plates are facing each other. When the hooks are positioned on a case or a box and the ends of the sling are placed on the cargo hook, the sling draws the studded plates tightly against the case as it is lifted. Box hooks are designed to lift heavy cases just high enough to permit easy slinging.

Box hooks should never be used for dragging cases in dragline operations. Also, they should never be used on fragile cases.

Chime or drum hooks are forged-steel flat hooks with an opening in one end through which a sling may be passed. The hooks are used in pairs. They are placed on the sling so that they face each other. The hook end is designed so that it fits the chimes of barrels or drums. The hooks are usually attached to endless chain slings. Several slings are then shackled into a spreader to form a bridle which will accommodate several drums at one time.

PLATE HANDLING CLAMPS

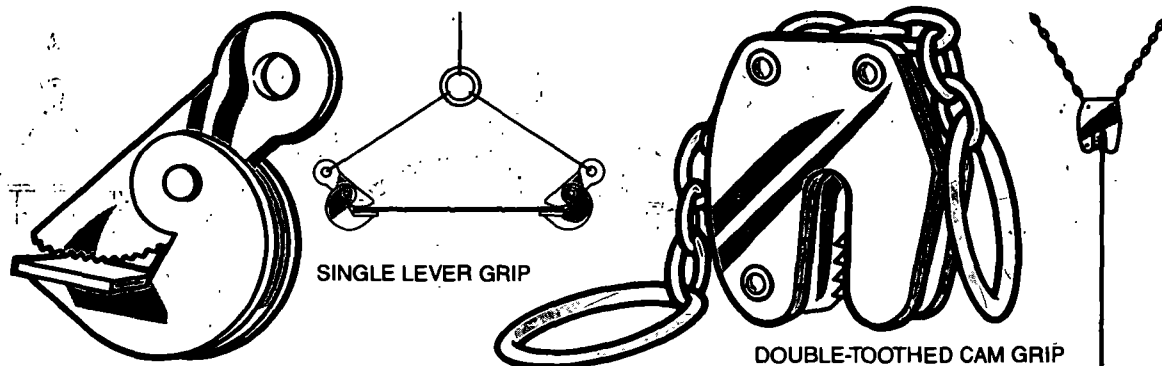
Plate handling clamps are clamps designed exclusively for handling steel plates. The two most common types used in military cargo handling are:

- Serrated jaw-type with **single lever grip** for lifting plates in a horizontal position.
- Serrated jaw-type with **double-toothed cam grip**. This is chain operated with a sling link for lifting steel plates in a vertical position.

One of the clamps has a vertical grip; the other, a horizontal grip. Both types have a 5-ton capacity, but the clamp with vertical grip can pick up only one plate at a time. Besides a vertical jaw opening, it has a double-toothed cam grip and

sling links. The other clamp is made of a tapered jaw opening, a toothed clamping arm, and an oval ring. Each type picks up the plate resting in the horizontal plane. The first type keeps it horizontal while it is being lifted. The second turns the plate over until it hangs vertically.

Similar to box hooks, plate handling clamps are safe for use only when the steel plate is not lifted to a great height. They are used to lift the plates into position to be properly slung with wire rope slings. Hoisting steel plates into or out of a hold with clamps may cause a serious accident. Since the clamps release when tension is removed, an unsafe condition could be caused by the plates hitting the coaming or the side of a hatch.



CARGO HANDLING AIDS

Cargo handling aids are used to help handle cargo. These include items such as hand hooks, wedge point bars (pinchbars), rollers, and tongs.

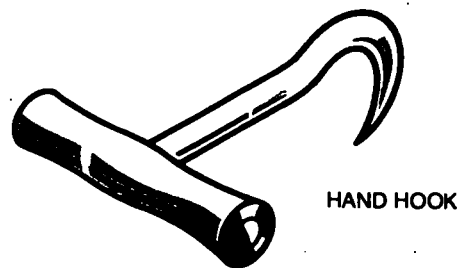
HAND HOOKS

The hook is used to move bags, cases, boxes, lumber, and bales from where they are stowed to the center of the hold for hoisting. It is also used to lift and carry such objects as coils of wire for short distances, and to pry up and roll large boxes and similar packages.

DO NOT handle the following cargo with hand hooks:

- Cardboard boxes
- Paper bags
- Ammunition
- Hatch boards
- Metal objects without holes to insert hooks
- Light wooden boxes
- Light sacks

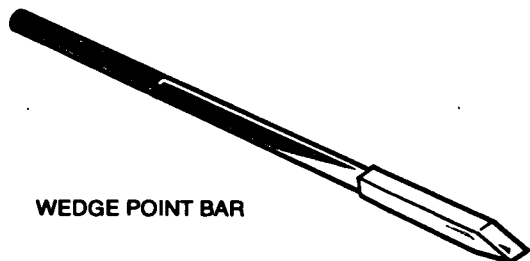
- Barrels
- Drums.



HAND HOOK

The hand hook has a hardwood handle fastened at a right angle to a steel shaft with a hook. The bag hook has a wooden handle and shaft and a metal "claw" constructed to engage burlap or jute.

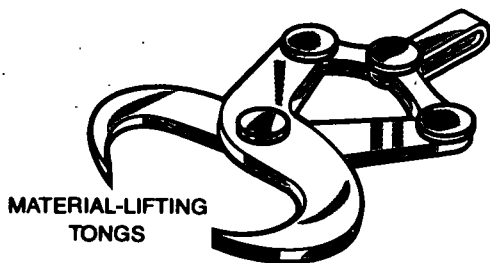
WEDGE POINT BARS



WEDGE POINT BAR

Wedge point bars have a wedge-shaped working end for prying. They are used to shift heavy cases into position over short distances with a grease-like substance called skid compound. For longer distances, the wedge point bar is used to pry the case up high enough to get rollers under it.

MATERIAL-LIFTING TONGS



MATERIAL-LIFTING TONGS

Material-lifting tongs have a 2,000-pound lifting capacity, double-lever action, and a jaw opening of 8 to 14 inches. Secure them to the cargo hook with a wire or chain to lift heavy timber. Use them only to lift the timber enough to put slings on it or to stack it. Do not attempt to carry timber over the ship's side with tongs. If the load scrapes any part of the ship, it will release the tension and the tongs will drop the draft.

ROLLERS

Rollers are used to move cargo from the wings and ends of a hatch to the square of the hatch.

CARE OF CARGO HANDLING GEAR

Cargo handling gear will last longer if it receives proper care and maintenance. The following simple rules will help prolong the life of the gear.

- Apply a light coat of oil to the wire rope slings periodically. A lubricated sling will wear five times longer than a dry sling.

- Clean cargo handling gear regularly.
- Insure manila rope slings are dry before storing to prevent mildew.
- Keep gear not in use in the gearbox or locker to prevent damage.

SAFETY PRECAUTIONS

The proper use of cargo handling gear will make the loading and discharging of vessels safer and easier. The following safety precautions should be followed when selecting and using cargo handling gear:

- Inspect all gear before it is used. Check slings for kinks, broken or frayed strands, and parting splices. Check shackles to insure that pins are straight and screwed in all the way. If a hook shows signs of straightening out, replace it with a serviceable hook. Check chain slings for signs of stretching.
- Know the safe working load of all gear (TM 5-725).
- Do not exceed the safe working load of any part of the rigging or of the cargo handling gear at any time.
- When using open hooks to hold snatch blocks, mouse the hook and the snatch block gate.
- Do not permit kinks, twists, or knots to form in the slings.
- Do not permit a sling to cross an unprotected sharp corner or edge.
- Be sure that hoisting slings are properly positioned on cargo hooks.

- Never carry a load on the point of a hook.
- Check welded rings and hook eyes periodically for cracks and distortion.
- Never overload a sling, and never apply loads suddenly.
- Never be too confident of a new sling; the fact that it is new is no reason for overloading it.
- Remember that as the angle of a sling is increased, its ability to support a load decreases. (Whenever possible, avoid angles of less than 45° from the horizontal.)
- When handling long drafts of cargo such as dunnage, pipe, and lumber, use tag lines and at least two slings.
- Never place a strain on the side of a pad eye.
- Condition all personnel to treat a draft as if it could fall at any instant.

Accidents caused by failure of cargo handling gear can usually be avoided by careful selection and use. Select the gear with care and inspect it thoroughly for serviceability before using it. Never use a piece of gear just because it happens to be handy.

SUMMARY

In this chapter we've discussed different kinds of cargo handling gear. We've talked about the kind of gear that is connected to or around the cargo. In the next couple of chapters, we'll discuss the equipment that actually lifts the cargo. The important point to remember is that all this gear works together. Like a chain, it is only as strong as its weakest part. Chafed, rusted, or strained

gear can support even less than its rated capacity. Further, if the gear is not connected together correctly, it could support less weight than you expect. All this means is that the cargo handler and his supervisors must be very familiar with all their gear from the sling to the crane and know the most efficient ways of using it.

CHAPTER 3 MATERIAL HANDLING EQUIPMENT

Material handling equipment (MHE) consists of large and mechanically-powered equipment used to lift, transfer, and stack cargo.

Properly used, MHE increases the economical use of manpower and decreases the multiple handling of cargo moving through terminals.

As a terminal operations coordinator, you must decide which type of equipment to use for a particular job. Also, you will be assisting in the operation of this equipment. The information in this chapter will give you a background on the different types of MHE.

FORKLIFT TRUCKS

Forklifts used in military break-bulk cargo operations range in capacity from 4,000 to 15,000 pounds. They have lift heights ranging from 144 to 210 inches. They are gasoline, diesel, or electric-powered vehicles. They are operated on

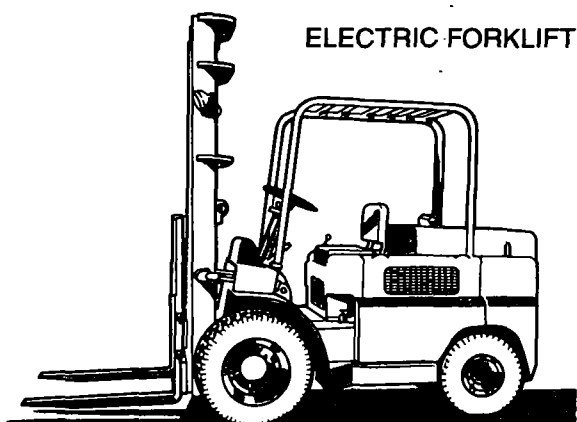
paved surfaces or rough terrain, depending upon job requirements. The type of forklift used depends on the type of job to be done. Gas and electric forklifts are useful aboard vessels to handle unitized cargo.

TYPES OF FORKLIFTS

The three types of forklift you will most likely encounter are gas powered commercial forklifts, electric forklifts, and rough terrain forklifts.

Commercial forklifts are designed to handle cargo on the pier, in the warehouse, and in the hold of a ship.

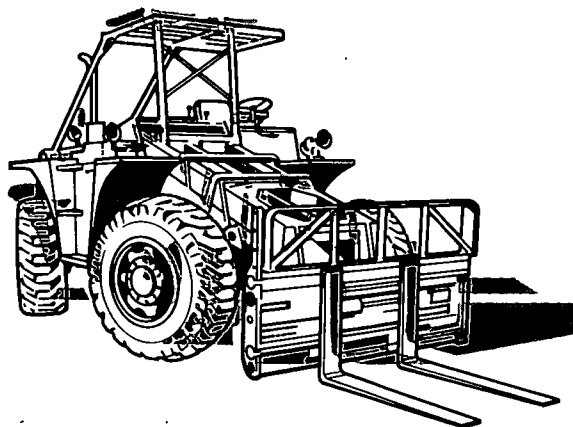
Electric forklifts are designed to handle military explosives in the hold of a ship.



Rough terrain forklifts are designed to move cargo off the road and over unimproved or soft surfaces, such as deep sand, mud, and snow. They have four-wheel power steering with independent controls for front and rear wheels. The steering operates all wheels in the conventional manner. A lever selects two-wheel steering, four-wheel crab steering, or four-wheel cramp steering. A rough terrain forklift has a ground clearance of 14 inches and can climb slopes up to 45 percent. The forks are power-operated. They tilt forward or backward to angles up to 45°, and to either side at angles up to 10° from the horizontal. The loaded forks may be extended from the upright position a minimum of 21 inches above ground level.

The 6,000-pound rough terrain forklift truck is mounted on low-pressure, high flotation pneumatic tires. All four wheels drive and steer. One hydraulic system powers the steering mechanism and another raises and lowers the lift. Special lifting arms are arranged so that the load can be raised or lowered in either a level or a pretilted position. For operations in landing craft, the forks

are raised or lowered and tilted forward or backward more than those of conventional forklift trucks. When carrying a load, the driver normally has a clear view over the package. If he

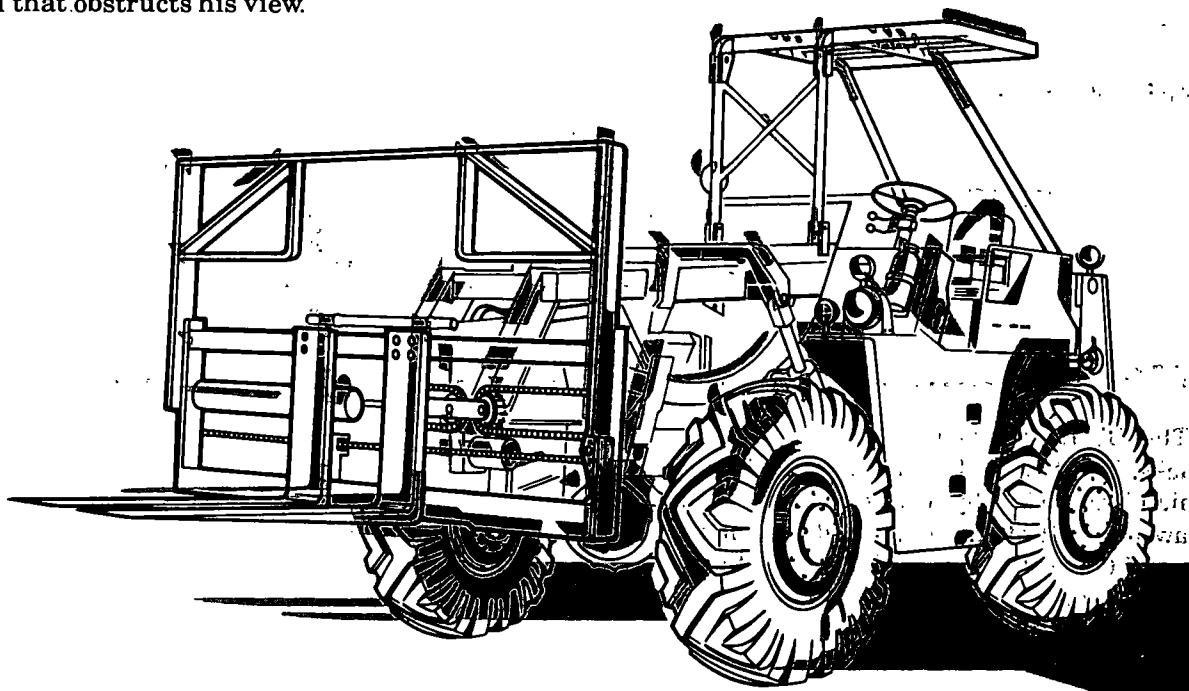


6000-POUND ROUGH TERRAIN FORKLIFT

does not, he must move the vehicle in reverse, looking to the rear over his shoulder as he does when he operates a conventional model with a load that obstructs his view.

Rough terrain forklifts are used in beach operations and over nearly all types of unimproved terrain. They can also be used on the pier to handle large cases or CONEXES. (A CONEX is a military container made of corrugated metal used to move cargo.) They are well adapted to transferring cargo from and to landing craft at the shoreline and for moving it in open storage areas. They can operate in water to a maximum of 36 inches without using waterproofing kits, and to a maximum of 60 inches with kits installed.

The 10,000-pound rough terrain forklift truck is constructed like the 6,000-pound forklift truck except that it is a larger vehicle. The primary difference between the two is that the 10,000-pound forklift is designed for operating in unimproved terrain. It has a lifting capacity of 10,000 pounds when the center of gravity of the load is within 24 inches of the mast.



10,000-POUND ROUGH TERRAIN FORKLIFT

SAFETY PRECAUTIONS

- Carry all loads tilted back slightly and just above the running surface.
- If the load blocks your view, drive the forklift in reverse.
- Never travel with a load tilted forward and never raise, lower, or tilt it while the forklift is in motion.
- Always face the direction that you travel. This means looking over your shoulder if you must drive in reverse.
- Always back down on ramps instead of going forward with the load in front of you.
- Never operate a forklift at a speed greater than 5 miles per hour.
- Always come to a full stop before changing directions. Avoid sudden stops.
- Do not allow passengers to ride on the forklift.

TRACTORS, TRAILERS, AND HANDTRUCKS

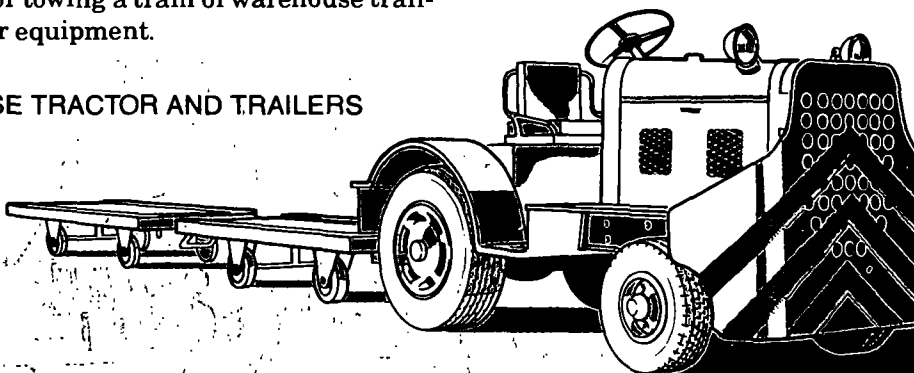
Tractors, trailers, and handtrucks are sometimes used to move cargo at terminals.

WAREHOUSE TRACTORS AND TRAILERS

A warehouse tractor is a short, compact vehicle having a short turning radius. It is usually equipped with a sheet-steel bumper for pushing other equipment. Further, it has a towing hitch in the rear for towing a train of warehouse trailers and other equipment.

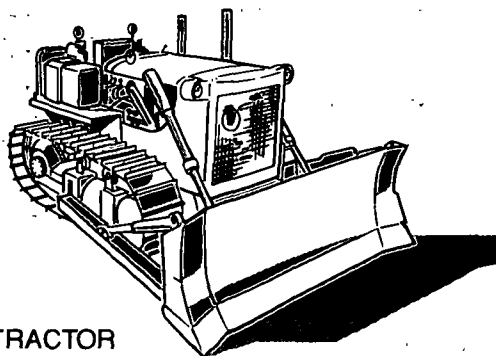
A warehouse trailer is a small-wheeled vehicle for transporting cargo over smooth surfaces. It is generally pulled by a tractor, but can be pushed as a four-wheeled handtruck.

WAREHOUSE TRACTOR AND TRAILERS



D7 TRACTOR

The D7 tractor is mounted on full crawler tracks. The tractor has a heavy blade in front which is moved by hydraulic pumps. Maximum draw-bar pull of this low-speed tractor ranges from 17,000 to 24,000 pounds. The tractor is used for heavy-duty jobs such as moving earth and towing. When its blade is sheathed in timbers to act as a buffer, it can assist landing craft in retracting or drawing away from the beach.



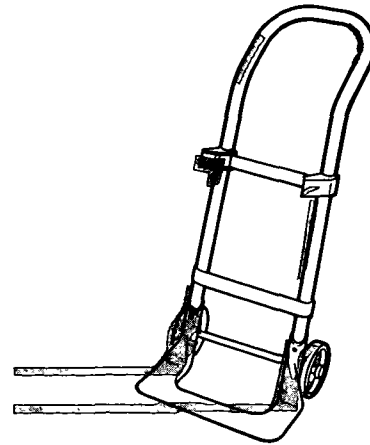
D7 TRACTOR

HANDTRUCKS

Handtrucks are used for moving packages too heavy to be moved by hand. They are also used for increasing the unit load of small packages on occasional short trips.

Some handtrucks have folding wings and curved braces between the legs so they can carry drums and barrels, as well as other types of packages. The wheels have solid or pneumatic rubber tires. The load capacity of the handtruck is 600 pounds and 95 cubic feet.

An improvised extension on the blade or nose at the bottom of the truck will increase its cubic carrying capacity. The nose or blade is used to pry drums, barrels, and heavy boxes. These must be tipped back to rest against the truck's bed. When the truck is properly loaded, the wheels bear the weight, relieving the operator of strain. But good loading is a matter of trial and error with the particular cargo to be moved. Always assign two



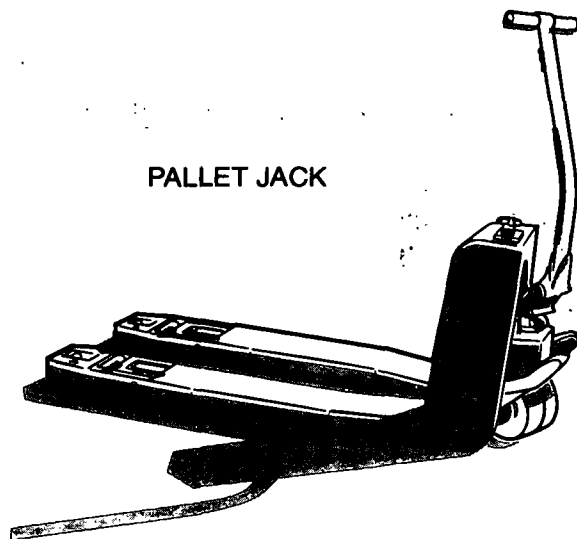
HANDTRUCK

men to the task, with the truck normally in an UPRIGHT POSITION. When it is ready to move, the operator puts one foot on the bottom cross-piece to keep the handle toward himself. He may be able to unload by himself, depending on the cargo.

PALLET JACKS

The pallet jack is a low-level hydraulic lift suitable for the horizontal movement of certain types of pallets. It can be operated by one man. Additionally, it is low enough to be passed through the

opening in the bottom of a pallet. However, when the pallet is raised, the rear wheels must have clearance to reach the floor or deck. The general purpose, four-way-entry pallet is designed so that it can be moved with a pallet jack. The pallet jack is not suitable for moving stevedore pallets.



PALLET JACK

Although the pallet jacks are not an authorized table of organization and equipment (TOE) item, they may sometimes be justified, obtained, and used to move palletized cargo into final stowage position underdeck. Since pallet jacks cannot be used to tier cargo, it is necessary to stow one tier at a time. Dunnage is laid between tiers so that the pallet jack can be maneuvered.

Pump the jack up by its handles. In pumping, the tines or forks are raised up on hinged rollers. They, with the wheels in front, support the jack as it is moved. Turn the valve on the top of the structure near the handle to the right when raising the jack and to the left when lowering it. The projections bracketing the front wheels are brake pedals.

CRANES

Cranes use a projecting swinging arm to lift, swing, and lower loads which cannot be reached by other equipment or are too bulky or too heavy to be moved otherwise. Since their chief advantage is their reach, they should never be used to

carry a load from one place to another except for short distances.

TYPES OF CRANES

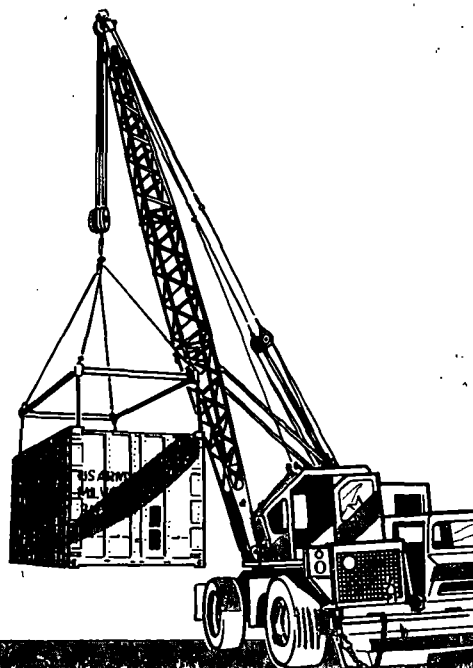
The three types of cranes discussed here are: rough terrain cranes, crawler cranes, and floating cranes.

Rough terrain cranes are wheel-mounted, diesel-driven cranes designed for operating in rough terrain. One rough terrain crane, with a 20-ton capacity and a 30-foot boom, is equipped with an earth moving blade for improving beach working area or making its own path in unimproved terrain.

Crawler cranes are especially useful on beaches and shores where ordinary wheeled vehicles would bog down. There are several types ranging in capacity from 5 to 50 tons.

In addition to unloading barges and lighters on beaches, crawler cranes are used to load and unload other modes of transportation at rail and truck points and on piers. They can also be loaded on lighters, where they are lashed down and used as floating cranes, provided the lighters are properly ballasted.

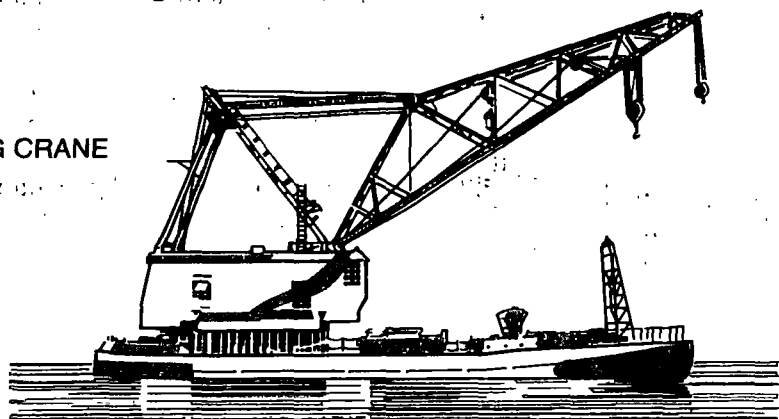
Floating cranes are cranes mounted on barges. They vary in lifting capacity. Some commercial cranes have capacities up to 240 long tons. The two standard floating cranes found in



20-TON ROUGH TERRAIN CRANE

the military inventory have capacities of 60 and 89 long tons. Their auxiliary hoist can lift 15 long

89-TON FLOATING CRANE



tons at a radius of 122 feet, 6 inches. The barge has an overall length of 140 feet and a beam of 70 feet.

Floating cranes work the offshore side of a vessel. Heavy lifts are discharged to the deck of the

crane or to barges tied alongside. Both cranes may reach across the ship and discharge the lift either on the pier or to clearance carrier equipment.

OPERATION

The safe and efficient use of a crane depends on the operator understanding its lifting capacity. While he cannot increase capacity beyond the limit set by the manufacturer, he must take into account the changes in capacity. These changes are caused by changes in the length or angle of the boom and in the resulting boom radius. The

boom angles are measured in degrees, starting at zero, with the boom parallel to the ground. Boom radius is the horizontal distance between the center of rotation (that is, the center of the turntable or the center pin) and a vertical line through the center of the hook. Signals for crane operations are shown in chapter 4.

SAFETY PRECAUTIONS

The following safety precautions should be observed when using cranes.

- To avoid possible damage to the machine or injury to personnel, the operator, or individuals in the vicinity, always check the crane and all slings, cables, chains, and hooks before starting an operation.
- Once motion is started, the crane must be kept level.
- Never swing a crane rapidly because centrifugal force can get the mechanism out of control or even upset the crane.

- Use standard signals for all operations.
- Keep the boom at least 10 feet away from power lines.
- Do not lift weights greater than the rated capacity of the crane for the boom radius you must use.
- Put all controls in neutral before servicing a crane or making repairs or adjustment, including trouble shooting.

SUMMARY

As we said before, materials handling equipment is designed to lift, carry, or stack cargo. The tractors, trucks, and forklifts are primarily designed for use on the pier or beach, to and from the warehouse, in the warehouse, or aboard ship. They provide limited lift capabilities. The big lifts are done by the cranes. They help load and

discharge ships, barges, and lighters either on the beach, on the pier, or at shipside. All this equipment can make easy work of the job of moving cargo from the warehouse or yard onto the ship, and off the ship back to the warehouse or yard. You are the person who must know which ones of these best suit your needs.

CHAPTER 4 RIGGING AND OPERATING SHIP'S CARGO HANDLING GEAR

When a breakbulk ship arrives at its port of discharge you, the terminal operations coordinator, have the job of offloading the cargo. How are you going to do it? Are you going to manhandle each piece of cargo from the vessel to the pier, or would it be simpler to use the ship's cargo handling gear to lift the cargo from the vessel and load it onto the pier? In this chapter, you'll learn how to rig the ship's gear and other equipment used in cargo operations. This equipment makes your work much faster and easier.

SHIP'S CARGO HANDLING GEAR AND EQUIPMENT

Before learning how to rig the ship's gear, it is necessary that you know what items make up the ship's gear and equipment. Among these items

are chains, shackles, blocks and tackle, standing rigging gear, running rigging gear, deck fittings, and cargo winches.

CHAINS

Chains are used in cargo handling operations for slinging loads, lashing cargo, and as a part of the ship's rigging gear. Chains are much more resistant to abrasion and corrosion than wire rope. This resistance makes chains last longer than wire rope. They are also used as slings to lift heavy objects with sharp edges which will cut wire. There are indicators that will warn the user if the chain is or has been under stress. Chains will stretch under excessive loading and each link will bend slightly. Bent links are a warning that the chain has been overloaded and may break suddenly under load. In addition to bent links, there is another warning of overloading. The chain is equipped with the proper hook. If the hook should start to fail first, this also indicates the chain is overloaded.

Chain size refers to the diameter in inches of the rod used to make the links. The size, angle of hookup, and number of chains being used will tell you how much weight you should lift with a chain.

The following precautions should be observed when using chains.

- When hoisting heavy metal objects using chains for slings, insert padding around the sharp corners of the load to protect the chain links from being cut. Either

planks or heavy fabric can be used for padding.

- Don't permit the chains to twist or kink when under strain.
- Never fasten links of chain together with bolts or wire because such connections weaken the chain and limit its safe working capacity.
- Remove worn or damaged links from the chain and replace with a cold shut link. Close and weld the cold shut link to equal the strength of the other links.
- Cut small chain links with a bolt cutter. Large chain links are cut with a hacksaw or an oxyacetylene torch.
- Inspect chains frequently.
- Do not paint a chain to prevent rusting because the paint will interfere with the freedom of action of the links. A light coat of lubricant is the best thing to use to prevent rusting.
- Store chains in a dry and well ventilated place to prevent rusting.

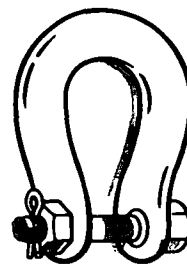
Tables defining safe load limits for various size chains will be found on page 2-5.

SHACKLES

Shackles are "U"-shaped pieces with a pin through the end. They are used to secure the chain to loads or anchoring structures. Anchor, antitoppling, and chain shackles are the principal types of shackles. Round, screw, and safety pins are the principal types of shackle pins.

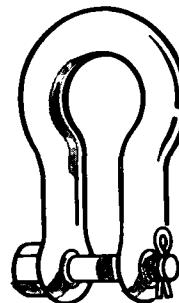
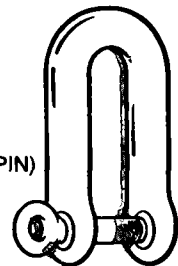
The following safety rules should be observed when using shackles.

- Pins must be straight.
- Screw pins must be screwed in all the way.
- Nuts on safety pins must be snug against the eye of the shackle and cotter pins must be inserted before the shackle is used.
- There must be no strain on the side of a shackle.
- Widths between the eyes must not be greater than they were originally. Excessive widths indicate the shackle has been strained and should not be used.
- When shackles are placed under stress, the bearing surface of the sling or fitting being used should cover the entire bearing surface of the shackle pin. If the size



ANCHOR SHACKLE (SAFETY PIN)

CHAIN SHACKLE (SCREW PIN)



ANTITOPPLING SHACKLE
(ROUND PIN)

of the sling or the size or design of the fitting makes this impossible, then use another size shackle. The formulas for estimating safe working loads and breaking strengths of shackles are found in Appendix B, and are valid only if the above safety rules are followed.

BLOCKS AND TACKLE

Blocks and tackle are necessary for moving, lifting, and stowing heavy cargo. This is because they change the direction of the pull and in-

crease pulling or lifting power. TM 5-725 covers information on blocks and tackles used by the terminal operations coordinator.

STANDING RIGGING GEAR

Standing rigging consists of lines and spars that don't move. The gear that actually does the work is attached to these spars. Standing rigging acts as bracing for the running gear.

Masts are principally used to support cargo booms. They also support signal lights, antennas, and crow's nests (observation posts). On most ships, each mast is fitted with a **crosstree** to which the topping lift blocks are secured, and a **mast house** which supports the heel of the boom. This is referred to as the heel block.

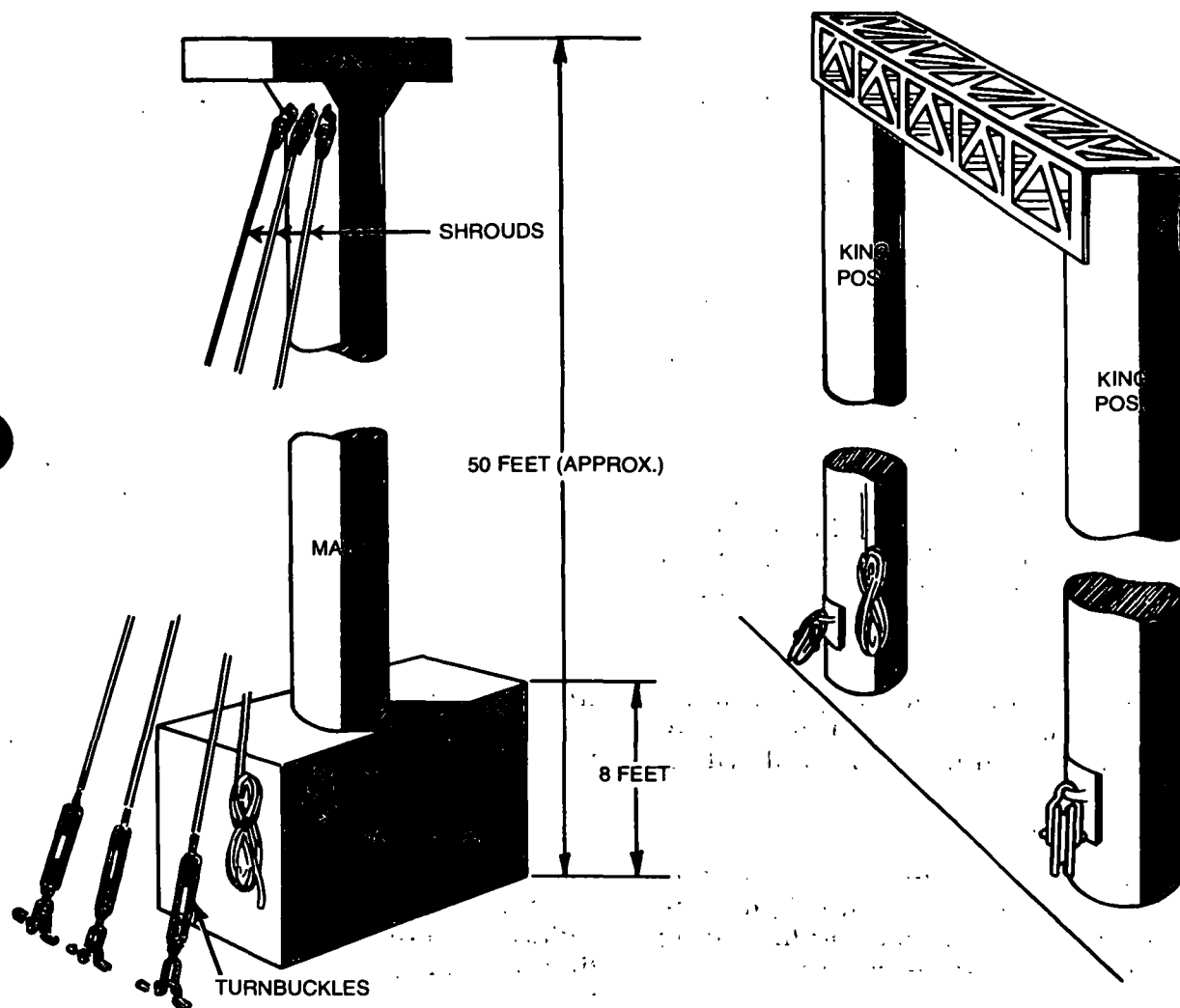
King posts are two vertical supports, usually steel, used to support booms. One of these is on each side of the centerline of the ship. King posts fixed with a spanner truss are called Samson posts.

Shrouds are heavy wire ropes that provide athwartship support for the mast or king posts. Two or more shrouds are used on either side of a mast or king post. They are secured to the deck or bulwark in an athwartship direction to provide maximum support.

Stays and backstays are heavy wire ropes similar to shrouds. They are found at the mast where the jumbo boom is located. When they support the masts or king posts from a forward direction, they are called stays. When they support from an aft (back) direction, they are called backstays. Additional stays and backstays are rigged

when unusually heavy lifts are being loaded and discharged.

Turnbuckles are internally threaded collars turning on two screws threaded in opposite directions. They are used to take up slack in the shrouds and stays.



RUNNING RIGGING

Running rigging is the moving part of a ship's gear. With regard to running rigging, you should be familiar with the following.

The **cargo boom** is a spar extending from a mast house or a king post. It is used as a derrick arm to handle cargo. Cargo booms are sometimes referred to as derricks.

The **cargo runner** is the cargo hoisting wire rope or line reeved through the boom **heel blocks** and **head blocks**. It is used for working cargo. The runner is also called the cargo fall or whip.

The **topping lift** is the tackle that raises and lowers the boom. Single and multiple topping lifts are used aboard ship.

The **single topping lift** is a single wire rope $1\frac{1}{4}$ inches or larger running through a single-sheave, **topping-lift block** at the crosstree on the mast or at the top of the king post. One end is shackled to the head of the boom and the other to the **bail plate**.

The **multiple topping lift** is a single wire rope reeved through a block at the head of the boom and a block at the crosstree. It is made fast on the **topping-lift cleat**. The size of the wire depends on the safe working load of the boom, but $\frac{5}{8}$ - to $\frac{7}{8}$ -inch wire rope is usually used.

Guy systems are blocks and tackle used to steady or swing booms. The three types of guys are **outboard**, **inboard** and **amidship** guys.

Outboard guys are secured to the outside of the head of the boom and to fittings on the deck or bulwark. These guys are often referred to as the working guys because they are the ones under the greatest stress. The stress on the guys appears when the load is being transferred athwartship. Stress also occurs when the weight is being supported anywhere between the two boom heads.

Inboard guys are secured to the inside of the head of the booms and secured to the deck or bulwark. Since the load on the cargo hook is always between the heads of the two booms or directly under one of them, there is little or no stress on inboard guys.

Amidship guys serve the same purposes as inboard guys. They hold the booms together and they have the advantage of being up and out of the way. Amidship guys consist of a light tackle between the heads of the two booms. The hauling part of the tackle is usually led through a block on the crosstree or king post. It is secured to a cleat.

The **preventer** is a wire rope used in addition to the outboard guys to reinforce them and prevent additional strain on them.

The **bail plate** is a triangular, steel plate with a hole in each corner to which are attached the topping-lift wire, the **bull chain**, and the **bull rope** on a single topping lift.

The **bull chain** is a heavy-duty chain made of links $1\frac{1}{4}$ inches in diameter or larger. It is used on a single topping lift to hold the boom in its vertical working position.

The **bull rope** is a wire rope used on a single topping lift to raise and lower the boom.

The **topping-lift cleat** is attached to the mast house or king post. It is used for securing the multiple topping-lift wire.

The **headblock** is the block at the head of the boom through which the cargo runner is led to the cargo hook.

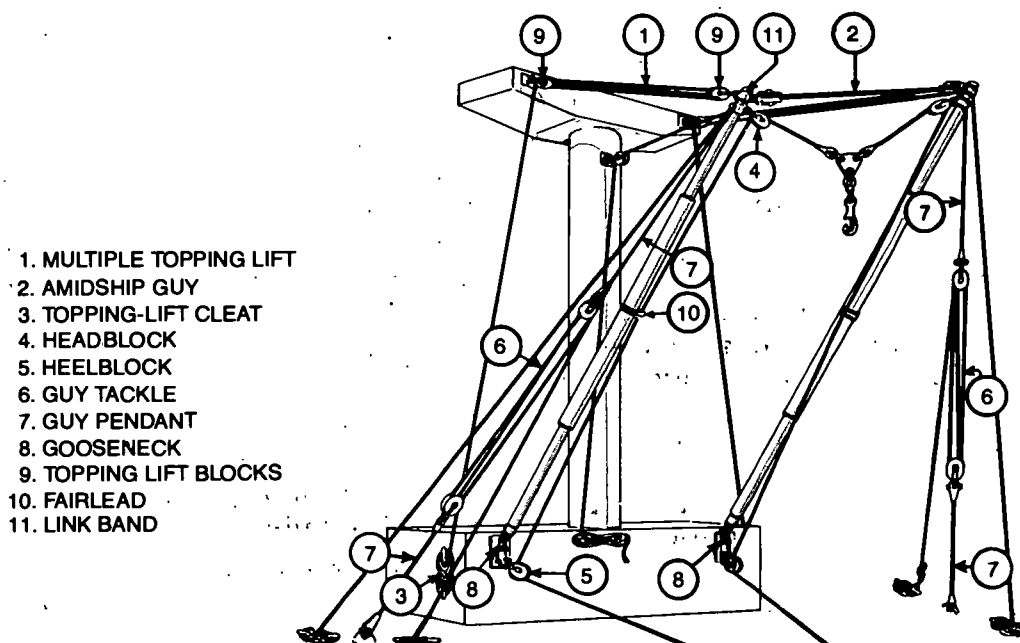
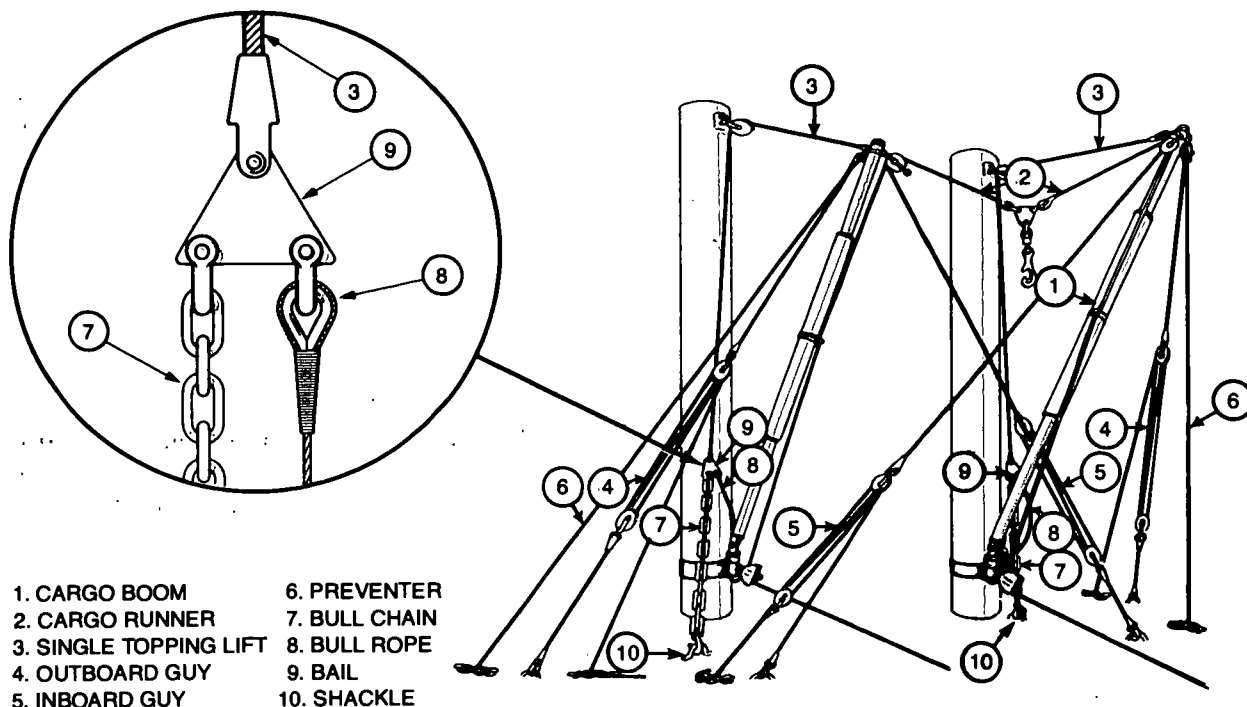
The **heelblock** is the block at the heel of the boom through which the cargo runner is led to the winch.

The **guy tackle** consists of the blocks and tackle used on guys.

The **guy pendant** is a short wire rope with a thimble or socket on each end. Guy pendants are used to attach the guy tackle to the head of the boom and to the deck or bulwark.

The **gooseneck** is a metal swivel joint that connects the heel of the boom with the mast or the mast house.

Topping-lift blocks are blocks at the head of the boom, the crosstree on the mast, or the top of the king posts through which the topping-lift wire is reeved.



The **link band** is a band around the head of the boom to which the topping-lift guys and head blocks are secured.

A **stopper chain**, a piece of close-link chain

about 6 feet long made of links $\frac{1}{4}$ to $\frac{1}{2}$ inch in diameter, is used to stop off the multiple topping-lift wire when transferring the wire from the topping-lift cleat to the winch and vice versa.

DECK FITTINGS

Deck fittings are the devices used to secure standing and running rigging.

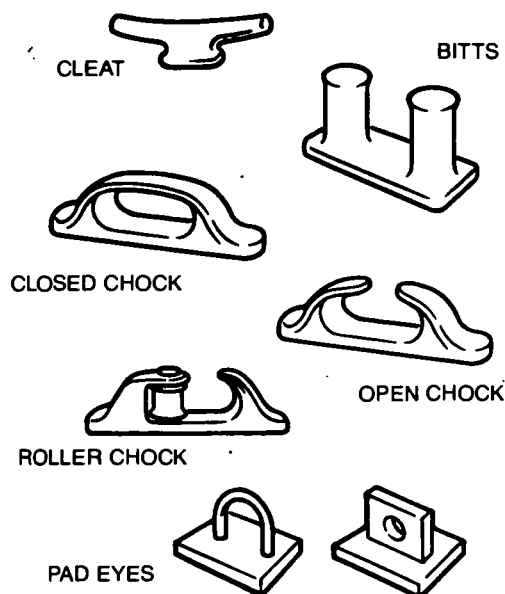
Bits are heavy metal bed plates with two iron or steel posts. They are used on ships for securing mooring or towing lines. Usually there is a set forward and after each chock.

Chocks are heavy fittings secured to the deck. Lines are passed through them to bollards on the pier. The types of chocks used are closed, open, roller and double roller.

Cleats are metal fittings having two projecting horns. They are used for securing lines.

Pad eyes are fixtures welded to a deck or bulkhead. They have an eye to which lines or tackle are fastened and are used for securing or handling cargo.

A bulwark is the wall around any deck exposed to the elements. This includes the weather deck, the poop deck, the fore deck, and any deck on the superstructure, such as the deck of the flying

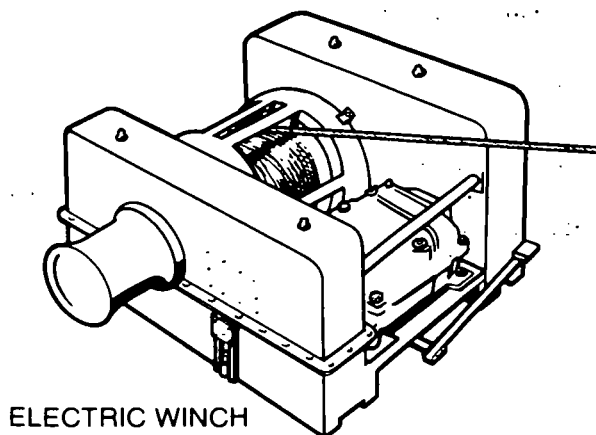


bridge. On top of the bulwark is a flat rail (or plate) called the rail. Pad eyes and cleats are often welded to the rail.

CARGO WINCHES

Cargo winches are the source of mechanical power in cargo handling operations. They are power-driven machines used to lift, lower, or move cargo. Winches are classified according to their source of power.

Electric winches are standard equipment on most vessels. An electric winch has a steel base



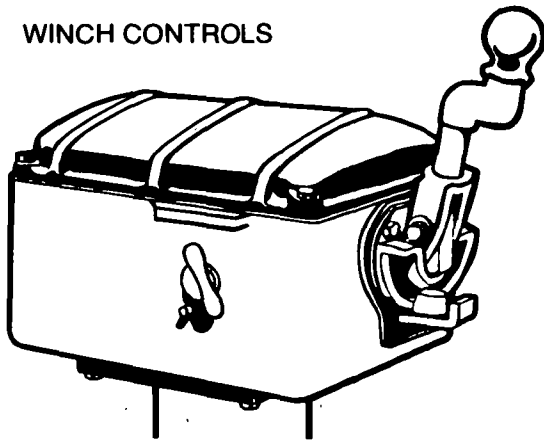
ELECTRIC WINCH

on which the winch drum, motor, gears, shafts, and brakes are mounted. The drum, which has cable wound on it, is usually smooth with flanged ends. It revolves on a horizontal axis and is driven through single or double reduction gears by an electric motor (usually direct current). A solenoid brake and a mechanical brake are fitted to the motor shaft. The winch is located on deck or on a deckhouse.

The winch controls consist of a master controller or switchbox located on a pedestal at the end of the hatch square and a group of relays, contactors, switches, and resistors located near the winch motor.

A resistor house is a small deckhouse between hatches when there is no larger deckhouse near the winch. In unit-type winches, control equipment is located in three compartments opposite the cathead side of the winch. The control panel, the resistor bank, and the solenoid brake are in these compartments.

WINCH CONTROLS



The control equipment regulates speed in both directions. The master controller is normally a five-speed, drum-type, reversing switch commonly found on modern cargo ships. An additional on-off power switch is located on the controller box.

The size of the winch motor depends on the maximum load to be handled on the booms and rigging. Heavier loads normally require changes in rigging and slower speeds. Although boom capacity ranges from 5 to 60 tons, a 50-horsepower motor is commonly used on all winches. Since most lifts are 1 to 5 tons, the winches and the rigging are designed to handle these loads at the highest speed practicable. Because the winch motor is a series motor, increasing torque will reduce the speed for heavier loads up to the maximum for the rigging arrangement.

Most winches are equipped with a solenoid brake on the motor shaft. The brake is set by heavy springs and released by powering up the solenoid coil. When the master controller is moved through the various speed positions to the off position, braking occurs for short intervals. Then, when the solenoid coil has power taken away, total braking occurs. At least once during every lowering operation, a load going downward at full speed must be slowed down and brought to a halt. This is done either when it reaches the deck or when held in the air. Although the speed could be slowed down by the friction brake, the frequent wear and tear would require unneeded replacement of brake lining. This could make it

necessary to have an oversized brake. Dynamic braking, on the other hand, slows down speed without causing wear on the brake lining. It requires the magnetic brake only for final slowing or stopping of the load. For emergency use, a foot-operated brake or other mechanical brake is usually included.

OPERATION

The steps used in operating the electric winch are as follows:

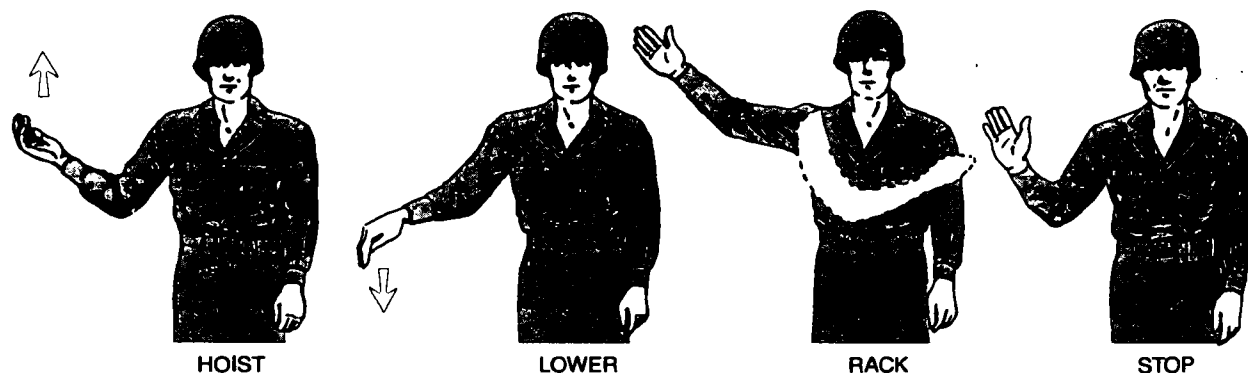
- Inspect the winch.
- Open control equipment ventilator covers.
- Turn the switch on the control box to the on position. (If it is necessary to leave the winch, the switch should be turned to the off position to prevent accidental starting.)
- Move the control handle forward to pay out cable, and backward to haul it back in.

The speed is set by the position of the control handle, the amount of cable on the drum, the weight of the load, and the line voltage. In case of an overload, the circuit breaker turns off the electricity. The circuit breaker is reset when the control handle is returned to the off position.

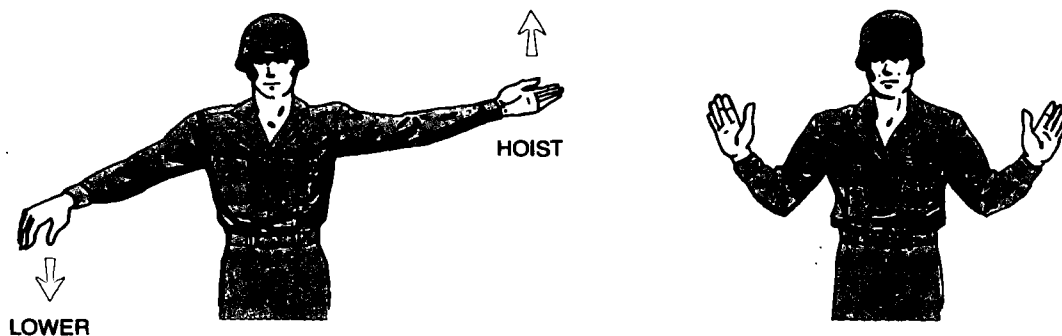
Running an electric winch at a slow speed over a long period of time causes the resistors to overheat and eventually burn out. By running the winches at a faster rate, the winch operator can avoid such breakdowns.

SIGNALS

Winch operators depend on the signalman to give the right signals at the right time. To insure swift, smooth, and safe movement of the draft, the signalman estimates the time it takes winchmen to react to the signals and winches to respond to the controls. A signalman directing two winchmen uses his right hand to signal the operator on his right and his left hand to signal the operator on the left. He faces the two operators but watches the draft (cargo being moved) at all times. The winchmen keep their eyes on him.



SIGNALS FOR ONE WINCH



SIGNALS FOR TWO WINCHES

A winch operator cannot always see the draft. Therefore he depends on the signalman for instructions. The safety and smoothness of the operation depend upon the judgment of the signalman and the skill of the winch operator to respond. A team effort is necessary.

Every member of the hatch section must know the signals used in cargo handling. Each signalman must also know the safe methods of slinging cargo and must satisfy himself that the draft is slung properly before giving the winch operator a signal to move it.

The signalman must learn to judge the few seconds that elapse between the time the signal is given and the actual stopping of the winch. If allowance is not made for this, accidents usually result. The signalman must place himself in such a position that he can see the draft at all times and that his signals can be clearly seen by the winch operators. Both should continually observe the rigging, paying particular attention to slack guys, chafing runners, loose pins in shackles, strained hooks, and any condition of slings or bridles which could be unsafe.

RIGGING STANDARD CARGO BOOMS

The crew of the vessel is responsible for breaking out the ship's cargo handling gear. However, circumstances may require you, as terminal operations coordinators, to know and understand the procedure for rigging cargo booms.

The procedures discussed here are general and are used in all types of rigs. Specific types of rigs will be discussed later.

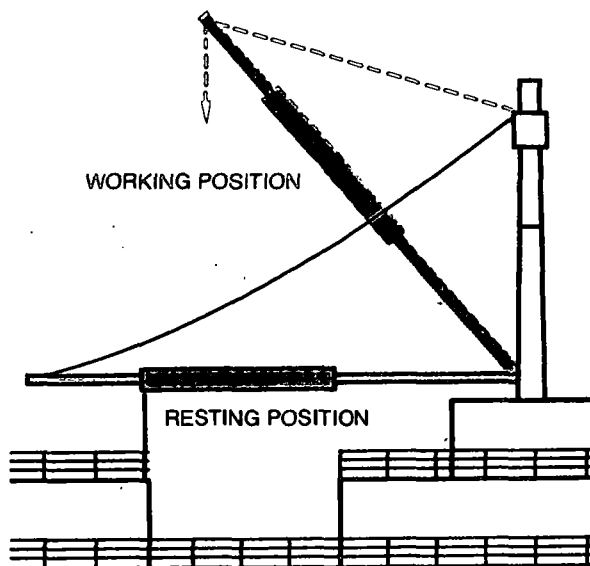
TOPPING A BOOM

When a ship is underway, the cargo booms are usually secured in a position horizontal to the deck with the head of the boom secured to a rest or cradle. To unload the ship, the boom must be returned to its working position. This is called topping (raising) the boom. It can be done using either multiple or single topping lifts.

MULTIPLE TOPPING LIFTS

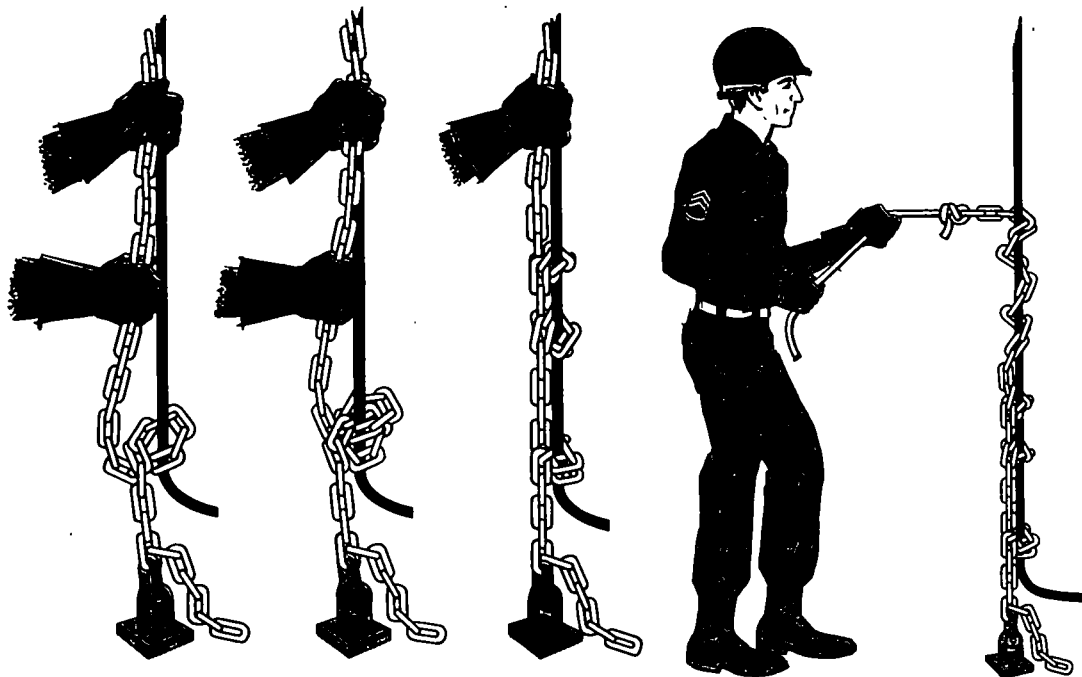
The procedure for topping booms with multiple topping lifts when the booms are in the cradle is as follows.

- Assign men to winches, guys, runners, topping-lift wire, and cathead.
- Prepare winches for operation.
- Lay out guys to proper fittings. (This is discussed in the section on equalizing guys and preventers.)
- Lay topping-lift wire along the deck or over the rail.
- Place hauling part of topping-lift wire in a wire rope snatch block.
- Take five turns with topping-lift wire around the cathead in the direction opposite to the cargo runner (underneath the cathead).
- Assign men to clear the topping-lift wire and attend the cathead.
- Assign men to outboard and inboard guys.
- Assign one man to overhaul the runner as the boom is topped.



TOPPING A BOOM

- Raise the boom to the desired height by putting the control lever of the winch in position for lowering.
- Next, take in on the hauling end of the topping-lift wire which is wound around the cathead.
- Secure the topping-lift by applying the stopper chain carefully as follows:



- With the stopper chain secured to a pad eye on deck, pass the running end of the chain around the topping-lift wire. Make sure that at the completion of the turn, the running end of the chain passes under the standing end of the chain.
- Run the running end of the stopper chain around the topping-lift wire again, making sure that this turn passes over the first turn.
- The chain's running end should again go under the standing end at completion of the turn. This completes a double half hitch, rolling hitch, or stopper hitch. Holding the stopper hitch tightly in place, take two half hitches above the stopper hitch.
- Wind the remainder of the chain around the topping-lift wire so as to bind the half hitches. Have one man hold the chain in this position.
- With the turns still on the cathead, slack off the topping-lift wire slowly until the weight of the topping lift is transferred from the cathead to the stopper chain.
- When the chain has the weight of the topping lift, remove the turns from the cathead and secure the topping-lift wire to the topping-lift cleat by taking three round turns on the cleat followed by three figure eights.
- Seize the last two figure eights to keep the turns from slipping or coming off the cleat. This is done by tying a thin line around the middle of the figure eights. Coil the remaining wire below the cleat or hang it over the figure eights if there is enough room.
- Remove the stopper chain. Swing the boom to its working position by hauling on the guys and spot (position it) according to the type of rigging desired.
- Equalize the guys and preventers. (See the section on guys and preventers.)

SINGLE TOPPING LIFT

The procedure for topping booms with a single topping lift when the booms are in cradles is identical to that for multiple topping lifts with two exceptions.

- On vessels rigged with single topping lifts, the catheads are equipped with a fitting to which the bull rope is secured instead of five turns being taken around the cathead as described above.
- The stopper chain is not used. Instead, the topping lift is secured as follows.

- After the boom has been raised to the desired height, shackle the bull chain to the deck.
- Slack off the bull line slowly until the chain supports the weight of the boom.
- Remove the bull line from the cathead and coil it around the cleat. It is only necessary to get the bull line off the deck and out of the way since it does not support the topping lift unless the boom is being topped or lowered.

USING GUYS AND PREVENTERS

GUYING

This procedure involves swinging or moving a boom by using wires or cables. There are two methods of guying the fixed booms for all types of rigging:

- Outboard and inboard guys.
- Outboard and amidship guys.

Both methods are used aboard cargo ships, although the outboard and amidship method is more common. If the inboard guy is used, it is necessary to find a place on the deck or bulwark to secure it. This puts additional gear in a location already overcrowded. Since the load on the cargo hook is always between the heads of the booms or directly under one of them, there is always less stress on the inboard or amidship guys than on the outboard guys. The lightweight amidship guy is sufficient to carry the stress and is raised aloft out of the way.

EQUALIZING GUYS AND PREVENTERS

In addition to the regular outboard guy on the fixed boom, an additional wire is attached to the head of the boom and led to the deck to act as a preventer. The preventer, which provides additional support to guys, is usually made of $\frac{5}{8}$ - or $\frac{3}{4}$ -inch wire rope. Take great care in the use of these preventers.

Avoid the unsafe practice of rigging the preventer so that the guy takes all the stress. This is unsafe since the draft may be dropped because the preventer takes stress only if the guy parts and then it gets all the stress, can't hold it, and it also breaks.

A preventer should not be expected to share all loads equally with the guy because the preventer is usually a single heavy wire while the guy has a manila or synthetic fiber purchase. This leads to a situation where if the guy and preventer have equal tension under a light load, the guys stretch much more than the preventer. Under heavy loads, the preventer has to take most of the increase. This can be avoided by adjusting the guy under a light load so that there will be a little more tension on it than on the preventer. Under a heavy load, then, the guy will stretch and let the preventer have its share.

The safest practice is to secure the guy and preventer as close together as possible without securing them to the same fitting. The desired equalization of tension between the two will not be achieved if the guy is in one place and the preventer in another. This is because under different degrees of tension the stress on one will increase more rapidly than on the other. Once the guys and preventers have been secured as close together as possible, the procedure for equalizing guys and preventers is as follows.

- Swing booms slightly beyond the spotting position (approximately 2 to 4 feet).
- Secure guys and preventers.
- Place a strain on the outboard guys and preventers by lifting a light draft equally between the two booms.
- Take in all the slack in the inboard or amidship guys. The booms will swing inboard to the desired position. This should nearly equalize the strain between the outboard guys and preventers, depending on how close together the guys and preventers are secured. As mentioned above, with this light draft there should be slightly more strain on the outboard guys than on the preventers. This is so that when a heavy draft is lifted, the differently constructed guys will stretch slightly, and thus equalize the strain between the guys and preventers.

When the guy and preventer cannot be nearly parallel, it is preferable that the guy be in the position of greater stress, i.e., more nearly in line with the fall under most conditions.

Neither the preventer nor the guy should have any slack in it. If one fails, the other will part

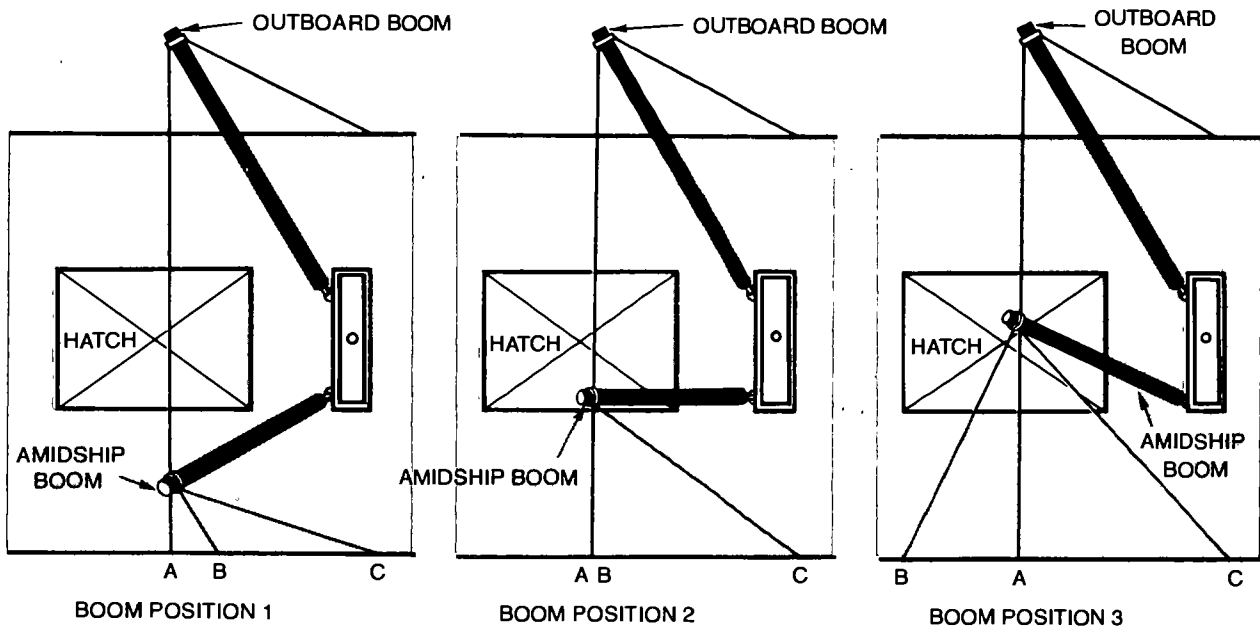
when it fetches up with a jerk after the slack is taken out. There will be two pieces of gear flying around instead of only one. In addition, if unnecessary slack is allowed to develop in guys, booms may slap about.

While there have been a few instances in which either the guy or preventer parted and the other held, it is undoubtedly true that the proper use of preventers has saved many a weak guy line. Preventers, therefore, should be considered useful only in keeping the guy from parting, not in holding the boom after the guy parts. A few vessels have heavy preventers (which are intended to carry the guy load) and very light guys (which are intended only for trimming the booms). Since little additional strength is provided by such guys, they should not be left slack.

POSITIONING GUYS AND BOOMS

The importance of properly guying booms with respect to the angles of stress cannot be over-emphasized, particularly when using married falls. When guys break because of overstress, the results could involve loss of time, cargo, and cargo gear, and even loss of life.

(SEE TABLE AT TOP OF PAGE 4-13 FOR STRAINS AT VARIOUS GUY POSITIONS)



STRAINS ON CARGO GEAR AT VARIOUS GUY POSITIONS

(Load, 1 S ton; falls, 30 degrees from horizontal)

Boom position	Guy position	Guy strain (tons)	Amidship-boom strain (tons)	Topping-lift strain (tons)
1	A	4.3	7.0	2.4
1	B	3.2	5.4	1.3
1	C	2.4	4.0	0.3
2	A	2.6	4.7	1.4
2	B	2.6	4.7	1.4
2	C	2.6	4.1	0.2
3	A	2.3	4.2	1.4
3	B	1.3	3.2	1.5
3	C	3.1	4.4	0.2

LOWERING BOOMS

The following procedures should be followed when lowering multiple topping lift booms.

- Assign men to winches, guys, runners, topping lift, wire, cathead, and stopper chain.
- Apply the stopper chain as explained earlier.
- Remove all the topping lift wire from the topping lift cleat, except the three round turns, and carefully "slack off on" (surge) the topping lift wire until the stopper chain supports the weight of the boom.
- Transfer the wire from the cleat through the snatch block to the cathead, taking five turns in the same direction as the cargo runner (over the cathead).
- Take up on the winch until the strain is transferred from the stopper chain to the cathead.
- Remove the stopper chain.

- Lower the boom using the winch.

While the booms are being lowered, men assigned to tend guys take in on the guy tackles. Those assigned to tend the runner overhaul it to prevent turns from piling up on the winch.

When booms are down, all gear is secured as follows.

- Rewind runners smoothly on the drum of the winch and secure the cargo hook to a ring or a pad eye with a slight strain.
- Secure guys to the heel block or fittings on the mast table and pull taut.
- Coil the hauling parts of outboard and inboard guys over the guy tackle and tie off the guys. Make amidship guys fast to the cleat on the mast.
- Secure the topping lift wires to the topping lift cleat.

THREE STANDARD CARGO BOOM RIGS

The three methods of rigging standard cargo booms used most often are the **yard-and-stay rig**, **West Coast rig**, and **wing and wing rig**.

YARD-AND-STAY RIG

One rig most commonly used on merchant ships for loading and discharging cargo, particularly when there is a new winch operator or

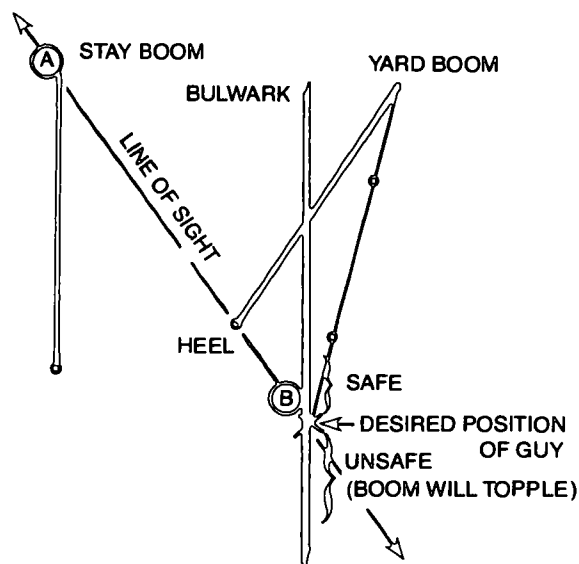
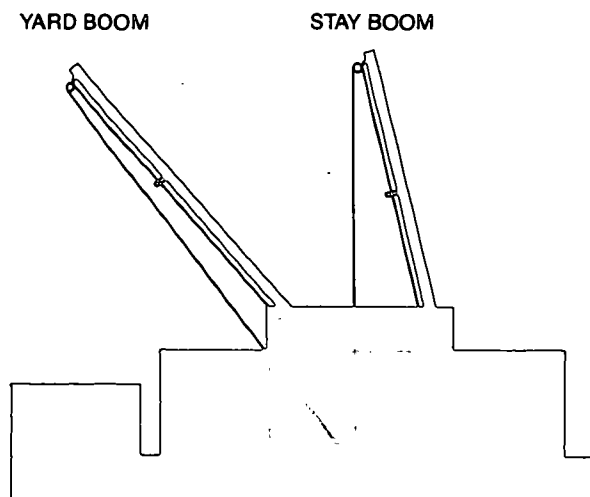
heavy drafts are involved, is the yard-and-stay system. This rig is sometimes referred to as the union, married falls, or Burton system.

This rigging method is advantageous when handling heavy drafts of cargo or oversize cargo. It is also advisable to use this rig when training new winch operators.

With the yard-and-stay rig, the yard boom is positioned over the pier and the stay boom is positioned over the center of the hatch.

With regard to positioning of guys, you should be familiar with the following.

- Secure stay boom outboard guy on the deck or bulwark in such a position that a horizontal projection of the line of the boom and the line of the guy will meet at an angle of 90° . Or, in other words, if the guy and the boom were lowered to the deck, they would form a right angle (90°) with one another.
- To find the position on deck or the bulwark to secure the outboard guy for the yard boom, the following procedure is used.
 - Take a line of sight from the *head of the stay boom to the heel of the yard boom*. Extend this line of sight to the bulwark of the ship.
 - The outboard guy of the yard boom is secured as close to this extended line of sight as possible. If it isn't possible to secure the guy at the extended line of sight, the guy should be secured between the extended line of sight and the head of the yard boom, *but as close to the line of sight as possible*. If the guy is secured too far from the line of sight toward the head of the yard boom, excessive forces will be introduced into the guy, boom and topping lift. If the guy is secured behind the line of sight and the heel of the boom, the heavy drafts of cargo will cause the top of the yard boom to raise up until it strikes the cross tree when the winch operator attempts to hoist the load. The cargo being lifted would slide across the hatch, slamming against the bulkhead cargo or personnel that might be in its path.



- Stand at position A under the head of the stay boom and look to the heel of the yard boom. Where the line of sight extends to the bulwark, this is the desirable position to secure the guy.
- The alternate method is to stand at B where you desire to secure the guy and sight from the heel of the yard boom on the head of the stay boom. If the head of the stay boom on the line of sight appears under the yard boom, it is safe to secure the guy.

OPERATION

In discharge operations, the cargo is attached to the cargo hook in the center of the hatch. The draft is lifted directly up by the cargo fall of the boom spotted over the hatch. At the same time, the slack in the other fall is taken up. As the draft reaches the desired height above the coaming,

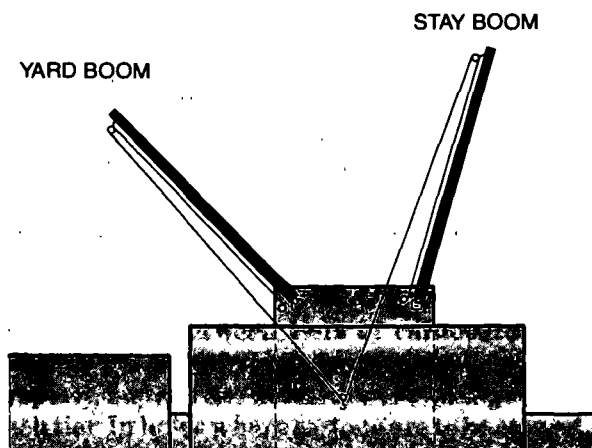
the lifting cargo fall is stopped and then slacked off while the fall on the outboard winch continues the lifting operation. This action carries the draft of cargo over the side of the vessel. The outboard winch then lowers the draft to the pier. In loading cargo, the operation is reversed.

WEST COAST RIG

The West Coast method of rigging is a modified form of the yard-and-stay method. It is the most common rig used by the military. This operation differs from the yard-and-stay method only in the way the amidship boom is spotted. There is a slightly different method of operating the winches.

The West Coast rig permits a little faster operation than the yard-and-stay. It enables the winch operator to position a draft of cargo on either side of the square of the hatch. The winch operator must use caution, because greater forces are developed in the gear for a given load than are experienced when using the yard-and-stay rig.

This is a modified yard-and-stay rig. The yard boom is positioned over the pier and the stay boom is positioned so that the head of the boom is outboard of the off-shore hatch coaming. Guys should be positioned as follows.

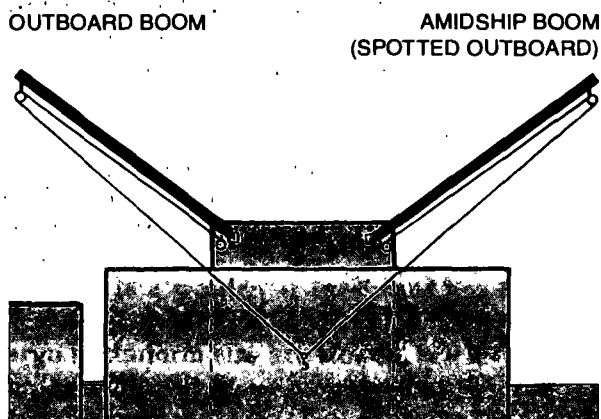


- The point where each guy should be secured is determined by the same method used for the yard-and-stay rig.
- The line of sight for the stay boom is taken from the head of the yard boom and the heel of the stay boom.

WING AND WING RIG

Another modification of the yard-and-stay method of rigging is the wing and wing method. This method differs from the yard-and-stay method in the way the booms are spotted and how the winches are operated.

The wing and wing rig permits loading or discharging on both sides of the ship. This method of rigging is used in LOTS operations. This particular type of rig is dangerous due to the great spread of the booms and constant hazard of the winch operator highlining, tautlining or fiddle string pulling of a draft of cargo. Even under the best of operating conditions great stress will be placed on all parts of the gear.



Both booms are winged out over the sides of the ship. This means that you have two yard booms.

The point where each of the outboard guys should be secured is determined by the same method as used for the pier boom in the yard-and-stay rig.

This rig can be used to work cargo in the hatch, but unless the coaming is equipped with rollers, the cargo runners will chafe against the coaming, wearing out the wire and butting grooves into the coaming.

RIGGING STANDARD BOOMS FOR HEAVY LIFTS

SAFE WORKING LOADS

Most ships are equipped with booms having a safe working load of at least 5 tons. The capacity of cargo booms is usually marked on the boom heel. If the safe working load is not marked on the boom, ask the ship's officers on watch for this information.

Winches vary in capacity. The exact capacity (leadline pull) is found on the manufacturer's nameplate on the machine or from a ship's officer.

Whenever the load to be hoisted by the yard-and-stay rig exceeds the safe working load of the rigging, use an alternative rig that will increase the safe working load.

Wire rope of $\frac{5}{8}$ -inch and $\frac{3}{4}$ -inch diameter is most commonly used for cargo runners, but some vessels are equipped with $\frac{7}{8}$ -inch runners. The

safe working load of $\frac{5}{8}$ -inch, new improved plow-steel wire rope is slightly more than 3 tons; $\frac{3}{4}$ -inch wire, slightly more than 4 tons; and $\frac{7}{8}$ -inch wire, slightly more than 5 tons. These safe working loads are for new wire. If the wire has been in use for some time or shows signs of wear, the safe working load must be reduced accordingly.

There are many methods of rigging ordinary booms for heavy lifts, but practically all involve doubling up the cargo runner. This not only doubles the safe working load that is picked up by the cargo runner, but it also decreases the strain on each winch by half. For a lift over 3 tons, $\frac{5}{8}$ -inch wire is doubled up. Although it is not necessary to double up a $\frac{7}{8}$ -inch runner to lift a 5-ton load safely, it is necessary to double it up so that the winch will pull the load.

SINGLE SWINGING BOOM

There are several situations which may require the use of a single swinging boom.

- One boom is damaged and cannot be used.
- It is necessary to load or discharge oversize light drafts.
- A ship is rigged with only a single boom at a hatch.
- One of the ship's winches needs repairs.

Rigging a single swinging boom on a standard vessel so that the boom is raised or lowered during the operation is accomplished as follows.

- The cargo runner on the boom, not being used is run off the drum of the winch, and the boom is swung out of the way. The

topping-lift wire of the working boom is fastened to the drum of the winch after the cargo runner is removed.

- The winch serving the working boom is used to raise and lower the cargo runner on the working boom.
- In order to swing the boom from side to side, two guys are used, both being secured at the head of the boom leading to the pad eye ring on deck or on the rail. Power to move the boom from side to side is furnished by using another set of winches, one for each guy. If power is not available, the boom is swung by hauling on the guy tackle by hand.

Four sources of power are needed to operate a single swinging boom rigged in this manner.

- One source raises and lowers the boom.
- A second source raises and lowers the cargo fall.
- A third source swings the boom to the right.
- A fourth source swings the boom to the left.

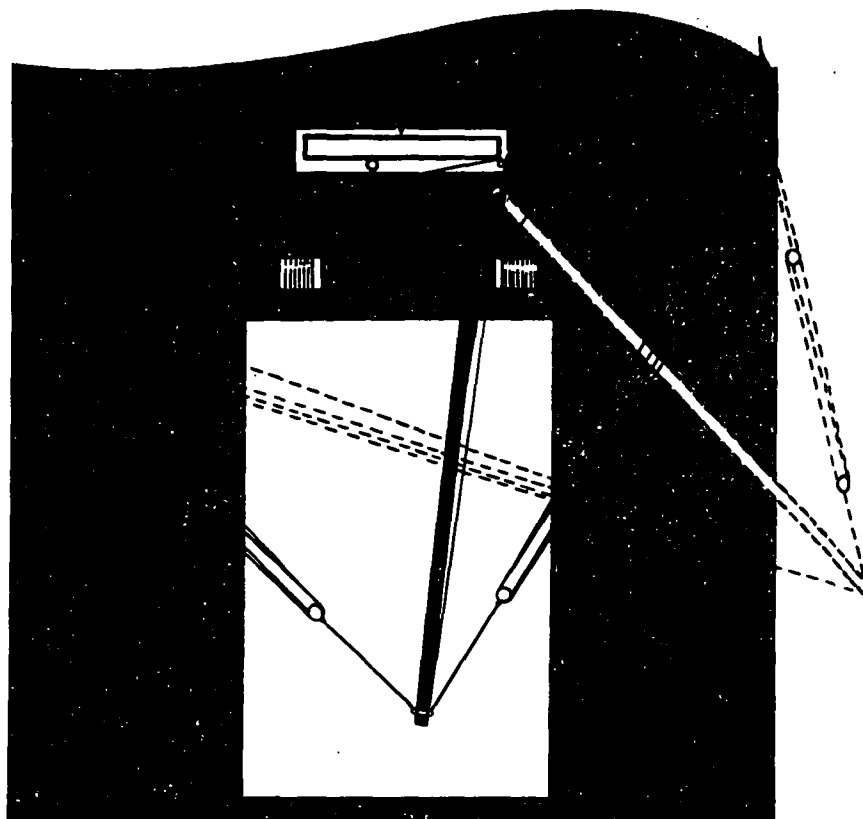
Vessels having only one boom at each hatch will normally have a source of power to which to attach the cargo runner, the topping lift, and the guys. Although the location of the power sources differs from that on the standard vessels, the method of rigging is the same as described above; i.e., topping lift, cargo runner, and guys are led to power.

It is necessary in some cases to rig the single swinging boom so that it can be raised or lowered during the operation in order to obtain enough drift to clear the hatch coaming or the side of the ship. For handling regular size loads of general cargo on most vessels, it will not be necessary to lead the topping lift to power. The boom is spotted so that it plumbs the hatch when swung inboard and plumbs the desired landing spot on the pier when swung over the side of the vessel. Men are assigned to haul in or slack off the guy tackles. This method requires only three sources of power. The use of manpower to swing the boom in either direction makes it impossible to work the single swinging boom with a single winch.

SINGLE SWING BOOM WITH DOUBLE PURCHASE

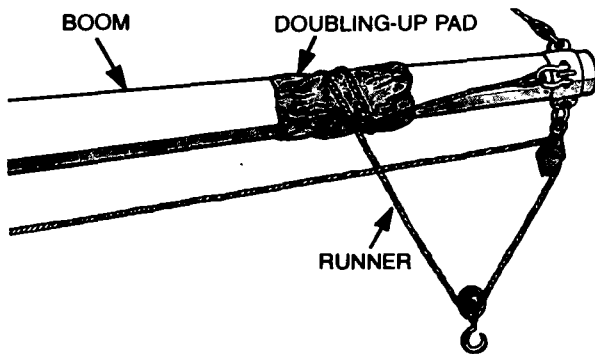
A single swinging boom is rigged to handle loads within the safe working load of the cargo

runner. But often it is necessary to lift loads that exceed the safe working load of the cargo



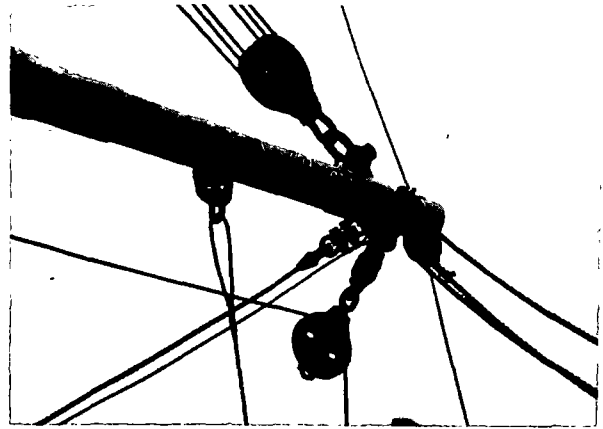
Loads that are within the safe working load of the boom, but which exceed the safe working load of the cargo runner, are safely lifted by rigging the boom as follows.

- Top the amidship boom, swing it out of the way, and lower the outboard boom to the boom rest.
- Fasten the topping-lift wire and the guys.
- Equip the outboard boom with a runner long enough to permit doubling up. An additional 12- or 14-inch block is required.
- Reeve the end of the cargo runner through the 14-inch *deep throat block* and secure it by one of the following methods.
 - Some booms are equipped with heavy doubling-up pad eyes about 4 feet from



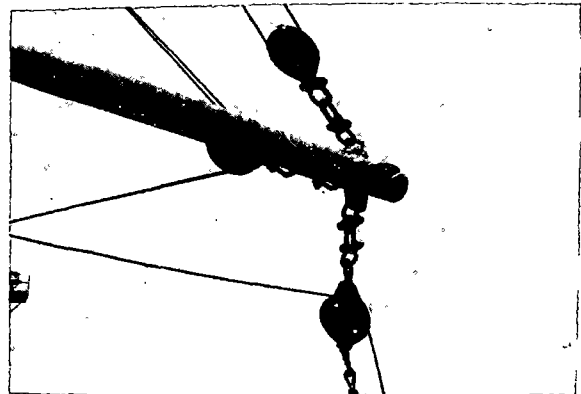
the head of the boom in line with the pad eye to which the headblock is attached. On this type, the eye splice in the cargo runner is shackled into the doubling-up pad eye. If available, a swivel is secured to the doubling-up pad eye, and the end of the cargo runner is shackled into the swivel. This will reduce the tendency of the wire to twist by taking the turns out of the wire at the swivel.

- Most cargo blocks used aboard vessels are double becket blocks. Double becket blocks are made so that shackles and swivels are attached to both the top and bottom of the blocks. Where



these blocks are available and there is not a doubling-up pad eye on the boom, the eye splice in the cargo runner is shackled into the bottom of the cargo block or into a swivel attached to the block. It must be remembered that the shackle or swivel at the bottom of the block must have a safe working load of at least half the weight to be lifted. For a 5-ton lift, use a $\frac{3}{4}$ -inch shackle or larger.

- If it is not possible to double up the rigging using either of the methods described above, the runner may be secured to the boom by taking two complete turns on the boom about 4 feet from the head of the boom and securing the eye splice to the link band.



The boom is operated in the same manner as the single swinging boom, single-rigged.

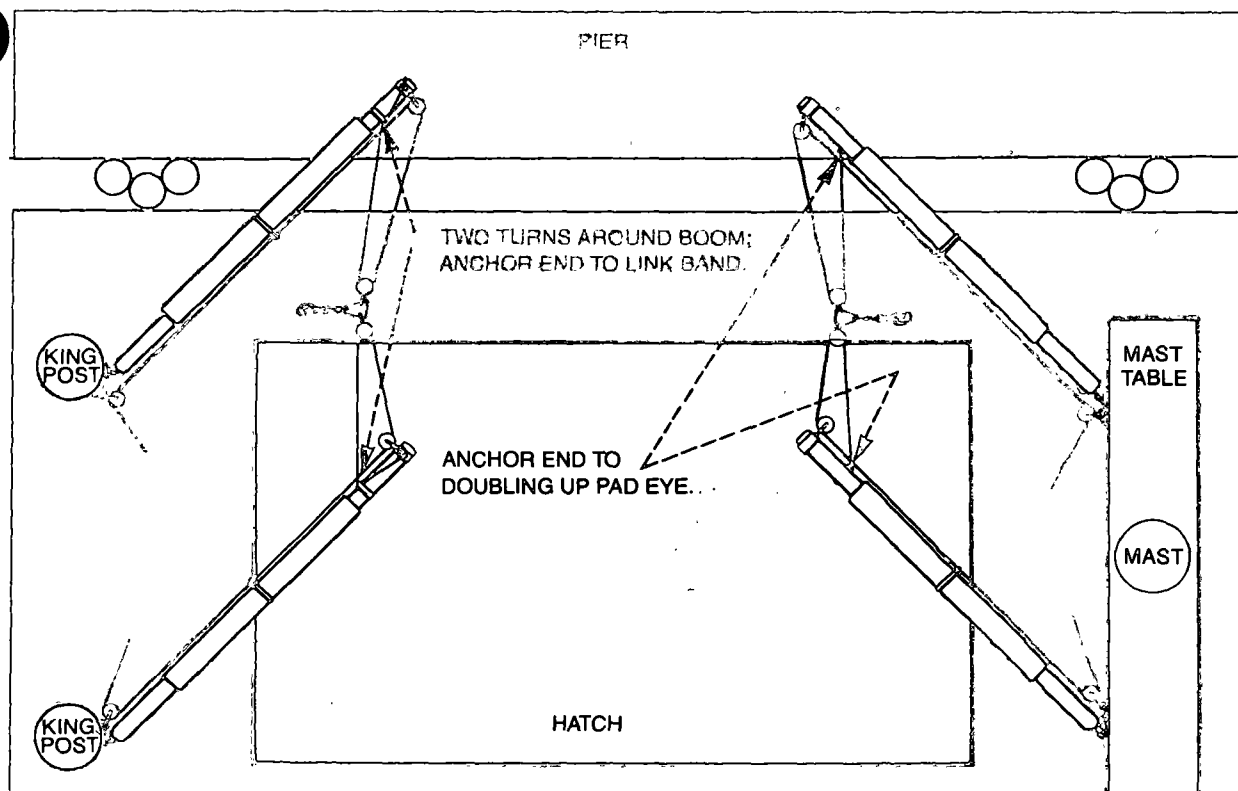
YARD-AND-STAY WITH DOUBLE PURCHASE

Doubling up with a swinging boom greatly increases the time required to transfer the load from the pier to the ship or vice versa. Time can be saved by using fixed booms rather than changing to a swinging boom operation. This is especially important when many loads just over the safe limit are to be handled. One of the easiest methods of augmenting the load limit is to rig both booms with a double purchase. This requires two additional deep throat 14-inch blocks. In working this rig, insure guys and preventers are in excellent condition and equalized as nearly as possible.

- The cargo runner of each boom is doubled up by any of the three methods described earlier. If the doubling-up pad eye on the boom is used, the hauling part of the cargo runner must be on the inside. If the cargo runner is secured to the boom by turns, the turns must be started on the inside of the boom so that the hauling

part of the runner is on the inside. These precautions prevent the hauling part from chafing against the standing part, because the hauling part leads from the heelblock to the headblock.

- When both booms have been doubled up, the two traveling blocks are married by shackling in a standard cargo hook assembly. The booms are topped, spotted, and worked as in a regular yard-and-stay operation. The chief advantages of this method of rigging are:
 - Lifts as heavy as the safe working load of the cargo boom can be handled at about half the rate of ordinary 1- or 1½-ton drafts.
 - Light filler cargo can be handled without stopping the operation to single up the rigging.



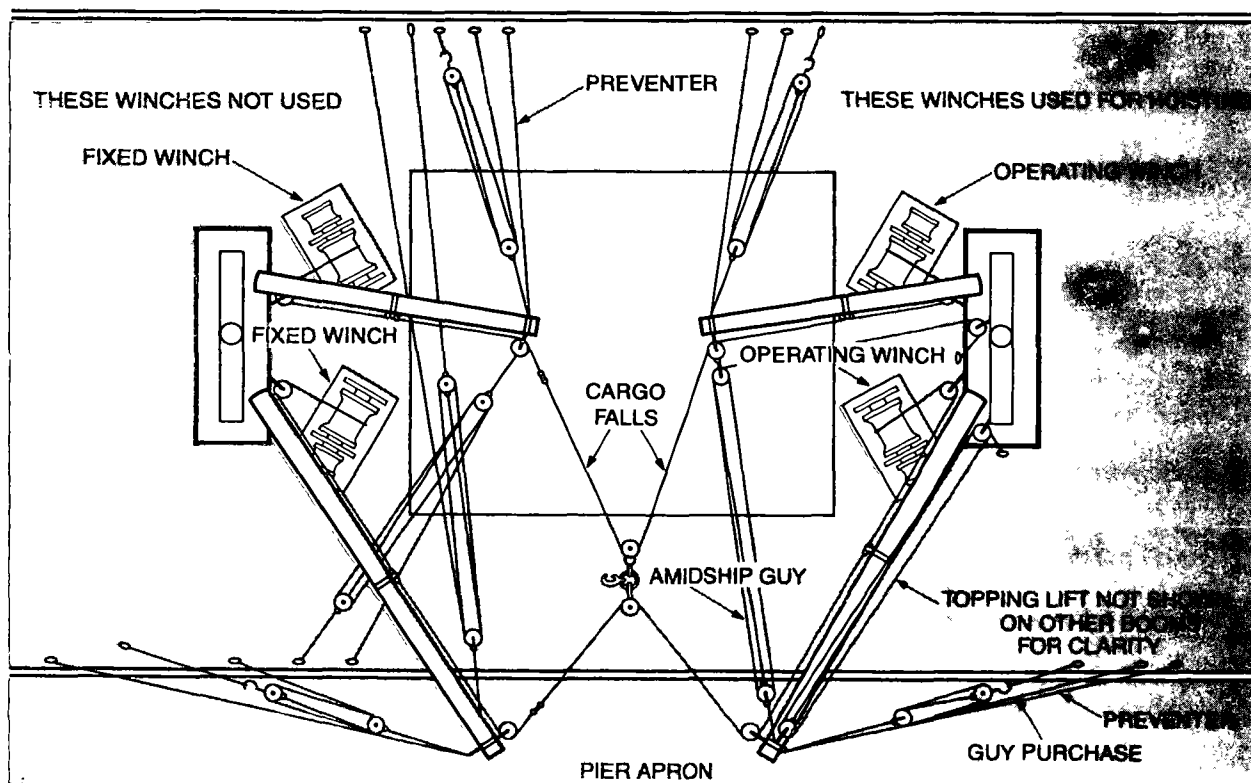
BLOCK-IN-BIGHT RIGGING ON DOUBLE-RIGGED HATCH

Handling heavy lifts at a hatch rigged with two pairs of ordinary cargo booms is made by rigging all four booms as follows.

- Reeve the runner of the forward amidship boom through a 14-inch deep-throat block and shackle eye-to-eye with the runner of the after amidship boom.
- Reeve the runner of the forward outboard boom through a 14-inch deep-throat block and shackle eye-to-eye with the runner of the after outboard boom.
- Hoist the shackles of the two sets of runners aloft to within a few feet of the head-blocks of the after booms.
- Marry the two blocks together for regular yard-and-stay operation.
- Be sure that booms are properly spotted and guys and preventers are equalized.

Heavy lifts not exceeding the safe working capacity of two parts of the cargo runner, the guys and preventers, or the combined safe working load of two booms may now be loaded or discharged by the usual yard-and-stay method. This type of rigging has the advantage of being quickly rigged without the necessity of lowering booms. Moreover, only two winches are required, and the gear may be readily singled up for ordinary light drafts.

Many modern vessels are equipped with topping-lift winches which are used only for topping or lowering the booms. When the boom is spotted, the winch is shut off and the topping-lift wire remains on the winch. This permits the booms to be raised or lowered rapidly simply by operating the topping-lift winches. Almost all heavy lift operations require a dragline operation. Therefore, if topping-lift winches are available, double-rigged hatches are rigged with the block-in-bight method as described on the following page.



- Lower the booms on the after end of the hatch and remove the runners and head-blocks from the booms.
- Reeve the cargo runners of the forward booms through 14-inch blocks, and shackle the runners to the link band of the opposing booms.
- Marry the two doubling-up blocks for regular yard-and-stay operation and raise the after booms to the desired height.
- Spot the booms and make certain that guys and preventers are equalized.
- Heavy lifts are now worked as described above, using the winches at the forward

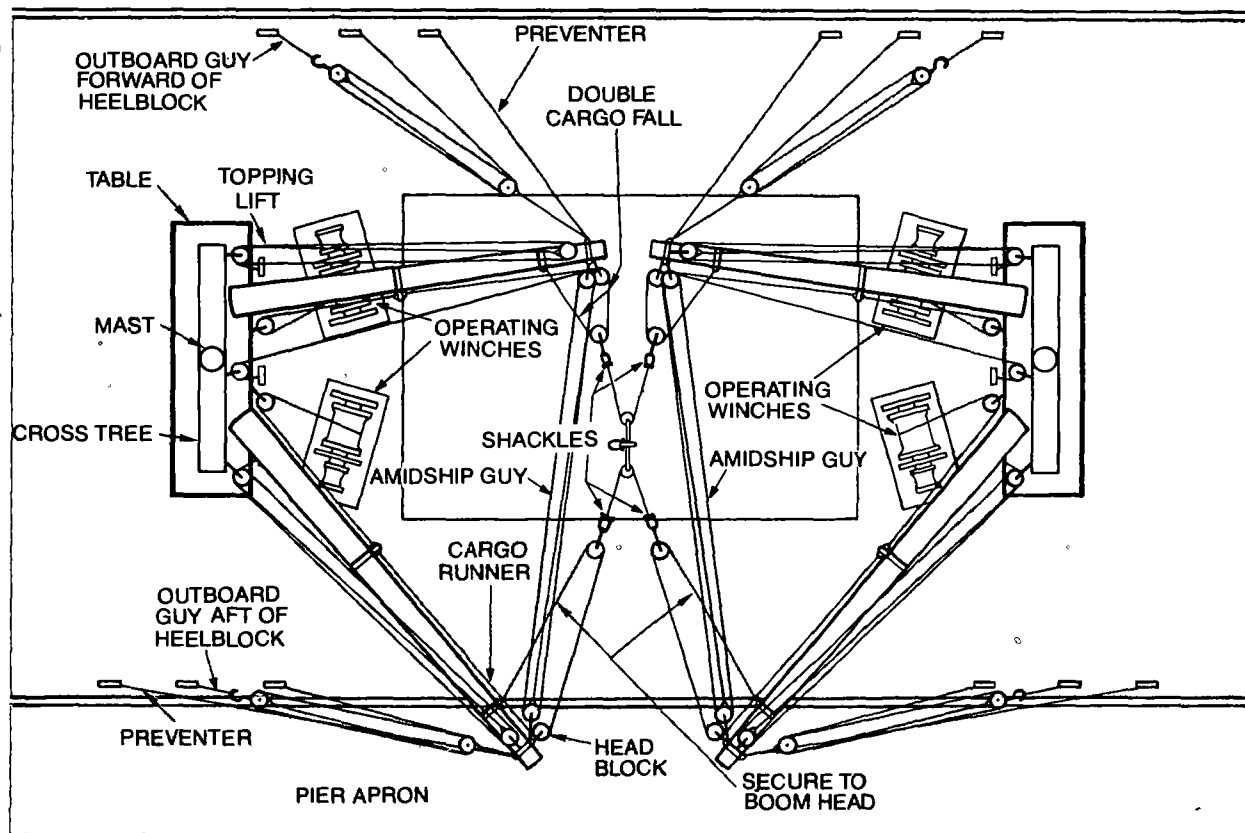
end of the hatch. The winches at the after end are available for dragline operations exclusively.

The method described above can be rigged much faster than the previously discussed methods. However, the time lost in lowering and the raising of the booms by using the topping-lift winch is more than made up by having two winches available for dragline operations. Lifts landed in the hold are quickly moved to their stowage place in the ends or wings of the hold during loading or into the square of the hatch during discharge. The dragline operation is going on while the previous load is moving to or from the ship and while the men are hooking on the next load or unhooking the previous load.

FOUR BOOMS DOUBLE UP ON DOUBLE-RIGGED HATCH

Winch operators must be highly skilled for this operation. **THIS METHOD SHOULD NOT BE USED EXCEPT IN CASE OF**

EMERGENCY. If possible, use a yard-and-stay rig.



This method of rigging a double-rigged hatch will handle loads up to the combined safe working load of two booms, provided the safe working load of two parts of the cargo runner equals or exceeds the combined safe working load of two booms. To lift a load of 9 long tons on a double-rigged hatch, using the block-in-bight method, requires the use of $\frac{7}{8}$ -inch cargo runners. The safe working load of two parts would be approximately 10 tons. However, it is possible to handle a 9-ton lift on a double-rigged hatch using smaller cargo runners by doubling up all four booms. This method is described below.

- Double up the runners of all four booms by reeving the ends of the runners through 14-inch blocks and securing to the head of the boom as described earlier.
- Marry the doubling-up blocks of the two outboard falls using a 1-inch wire strap reeved through a 14-inch block.

- Marry the doubling-up blocks of the hatch falls using a 1-inch wire strap reeved through a 14-inch block.
- Shackle these two blocks together, using shackles $1\frac{1}{4}$ inches or larger.
- Check all guys and preventers carefully to make sure they are correctly placed and equalized. The two 1-inch wire straps that are reeved through blocks joining the outboard falls and the hatch falls serve as equalizers in case the winches are not synchronized in making the lift.

If the booms are equipped with inboard guys instead of amidship guys, the inboard guys are led outboard to further strengthen the outboard guys. The weight of the blocks and the load will keep the booms from swinging outboard. The lift should be carried close to the deck to avoid a fiddlestring pull. If possible, use a yard-and-stay rig.

RIGGING JUMBO BOOMS

Tanks, landing craft, tugs, picket and patrol boats, and other extremely heavy cargo required by the Armed Forces in the field present complex problems in cargo handling operations. At loading terminals in the United States, loading a heavy lift is a fairly simple operation. However, at oversea bases, shoreside equipment or floating cranes are not always available. Often the ship's gear must be used for discharging heavy lifts. Many modern ships are equipped with one or two jumbo booms having capacities of 50 to 120 tons. They are generally located at the larger hatches

of the vessel. Many ships used in task-force operations, particularly in securing beachheads, are equipped with heavy lift gear at practically all hatches for quick discharge of heavy equipment like landing craft, tanks, and bulldozers. A few American ships specially fitted for heavy lifts have jumbo booms with capacities up to 240 tons. You, as terminal operations personnel, operate heavy lifts. For this reason, the rigging and operation of the jumbo boom must be understood.

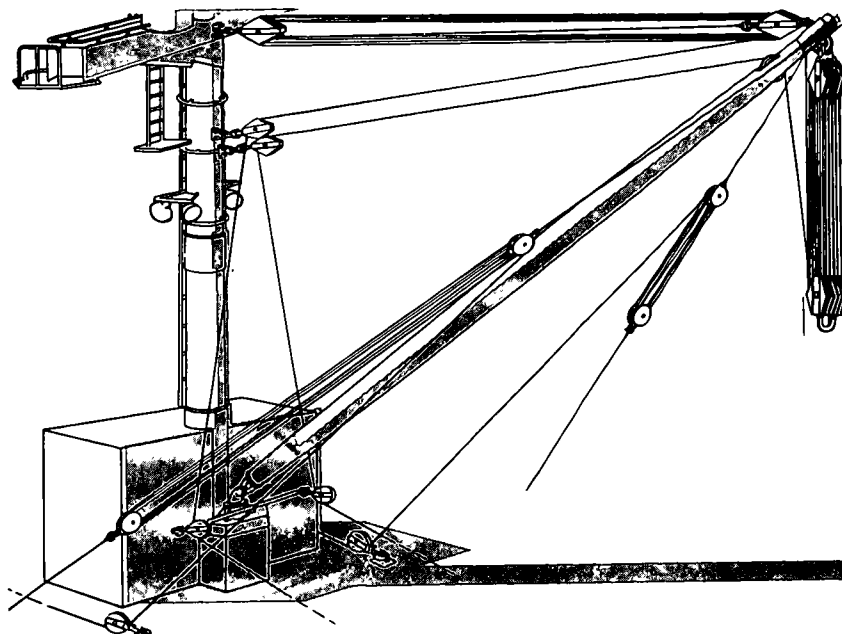
RIGGING

Most heavy lift booms are fully rigged with topping lifts, purchases, and guy tackles already secure. In order to save space on deck for cargo, the jumbo boom is generally carried in an upright position against the mast.

The first step in rigging the jumbo boom is to lead all purchases to power.

- Sources of power are required for:

- The cargo fall to raise and lower the cargo hook
- The topping lift to raise and lower the boom
- Each guy tackle to swing the boom from the hatch opening to the pier and return.



- If only two winches are located at a hatch, the two additional sources of power are supplied by the warping winch or winches at an adjacent hatch. On double-rigged hatches, the winches on the opposite end of the hatch are used.
- Sources of power are normally used as follows:
 - The cargo runner is led through a heelblock to one winch at the hatch worked.
 - The topping lift is led through another heelblock to the second winch at the hatch being worked.
 - The two guys are shackled to pad eyes, and the hauling parts of the guys are led through a series of snatch blocks to the additional sources of power.

At this point, all purchases have been led to power and the guys have been secured, but the boom is still held fast to the mast. The shrouds and stays should be checked, secured, and tightened if necessary.

The next step is to remove the collar or lashing that holds the boom to the mast. This is accomplished as follows.

- If possible, take a strain on the topping lift wire to release the pressure on the collar or lashing. In vessels where this is not possible, use a breasting-up line in the following manner.
 - Make the breasting-up line fast to the boom, either by passing it around the boom or shackling it into a pad eye that is on the boom for this purpose. Pass the line through a snatch block on the mast, and fairlead it to the cathead on the winch.
 - Take a strain on the breasting-up line and release the collar or lashing that holds the jumbo boom in place.
 - Slack off the line slowly until the weight of the boom is on the topping lift.
 - Remove the breasting-up line, and lower the boom into position with the topping lift.
- In either of the methods mentioned above, men are sent aloft to release the boom.

GUYING

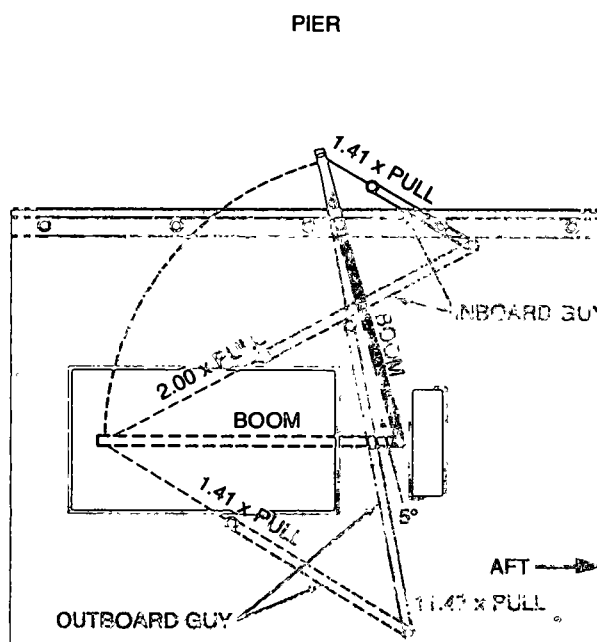
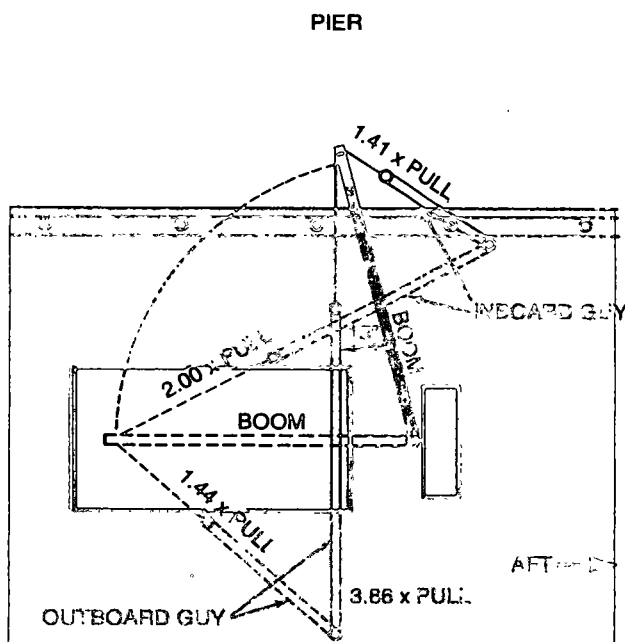
The rated capacity of a boom is the safe load that it will lift only when it is properly rigged, guyed, and operated, and when the stays are properly placed. Take care in rigging to prevent undue strain on the boom and the guys.

On single-rigged hatches, it is usually advisable to use the anchor windlass for the forward jumbo boom and the mooring or warping winch for the after jumbo boom. Lead one guy over the top of one cathead. Lead the other guy underneath the other cathead so that one guy is pulling while the other is slacking off. Let only experienced men operate the guys. Make sure the direction of rotation of the winch or windlass is clearly understood by all so that when the proper signals are given, a slow, smooth operation will result with minimum strain on the takeup guy and proper slack on the following or slacking guy.

On double-rigged hatches, the guys are led to the winches on the opposite end of the hatch.

As the guys approach the vertical, the strain on the guys and the boom increases while the

angles between the guys and the boom decrease. To place the guys properly, give the guy with the greatest strain the largest angle between the guy and the boom. The two illustrations below show the horizontal strains involved when the guys are placed on a heavy lift boom for loading from or discharging to the pier. For example, assume that the ship is being unloaded. The outboard guy has been so placed that the angle between the guy and the boom is 15° in the illustration on the right and 5° in the illustration on the left. Assume that a 3,000-pound pull (indicated by the letter P) is placed on the inboard guy while the brakes are applied on the outboard winch. The inboard guy would have the same strain as in the illustration on the right, but the outboard guy would have a strain of approximately 34,500 pounds. This would decrease the angle between the outboard guy and the boom by 10° , and triple the strain. Shifting the outboard guy too far forward causes too steep an angle with the boom. This is particularly true if the boom has to be raised to handle cargo in the after part of the hatch.



OPERATING

Before operating the jumbo boom, swing the standard hatch booms clear of the working area. Generally, it is sufficient to swing these booms against the shrouds. Secure them with their guys, or it may be necessary to top them when working deck cargo. After the standard booms are secured, proceed as follows.

- Check gear thoroughly to insure that:
 - Blocks are running free
 - No lines are chafing
 - The turns on the winches lie evenly
 - Snatch-block gates are securely moused to prevent opening
 - Guy tackles are free of twists and are guided through fairleads to sources of power
 - Stays are secured and tightened.
- Insure that signalmen, winchmen, and men tending guys clearly understand all signals. Additional signalmen are necessary to relay signals to men tending guys at the windlass or warping winches. However, the number of signalmen should be kept to a minimum.
- Sling the draft carefully and shackle the slings into the traveling block on the cargo runner. After a final check to see that everything is secure, hoist the draft a few

inches off the deck and recheck all rigging.

- Avoid faulty winch operations, sudden stops, and quick starts. Properly planned heavy lift operations move slowly and smoothly.
- Carefully hoist the draft until it clears the hatch coaming and rail.
- Adjust the angle of the boom by taking up or slacking the topping lift.
- Every change in direction of the boom requires an adjustment of the guys. As the boom is raised, slack off the guys. As it is lowered, tighten the guys.
- The boom is swung by taking up on one guy and slacking the other. When working a jumbo boom, give close attention to handling the guys. When a boom is swung either inboard or outboard, one guy is the hauling guy and the other is the following guy. Maintain just the right amount of slack in the following guy to prevent undue strain on the hauling guy. Too much slack in the following guy might allow the draft to get away.
- Use the following guy to control the boom's tendency to swing in the direction of the list which occurs in a tender ship when a load is swung outboard.
- Lower the draft by slacking the cargo runner.

SIGNALS

The uniform system of signals recommended for use in directing jumbo boom operations is shown on the following page.

The signals in use should be posted at the operator's position, at the signal control points, and at such other points as necessary to properly inform those concerned. Where manual (hand) signals are used, *only one person shall be designated to give the signals to the operator.* The signalman must be located so as to be clearly visible to the

operator at all times. Only persons who are dependable and fully qualified by experience with the operations being directed should be used as signalmen. A signalman should be provided whenever the point of operation is not in full and direct view of the machine or equipment operator. A warning device or services of a signalman should be provided wherever there is danger to persons from moving equipment.



RAISE LOAD



RAISE LOAD SLOWLY



LOWER LOAD



LOWER LOAD SLOWLY



RAISE BOOM



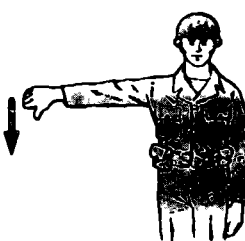
RAISE BOOM SLOWLY



RAISE BOOM AND
HOLD LOAD



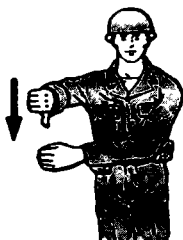
RAISE BOOM AND
LOWER LOAD



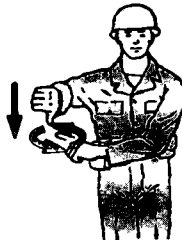
LOWER BOOM



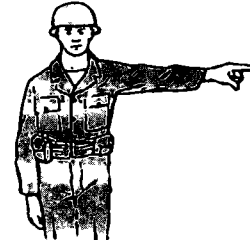
LOWER BOOM
SLOWLY



LOWER BOOM AND
HOLD LOAD



LOWER BOOM AND
RAISE LOAD



SWING LOAD IN
DIRECTION FINGER POINTS

When the unloading of one hatch is complete, shift the jumbo boom to the next hatch. This is done in the following manner.

- Swing boom to centerline of ship.
- Raise boom until nearly vertical (about 85°), keeping boom at centerline of ship. A limit switch is used to cut off topping winches when the boom is raised to 85° above horizontal.
- Suspend the lower cargo hoist block to a position that is easy to get at from the winch house.
- Secure the handling pendant to the lower cargo hoist block and raise the lower block to about 10 feet from the upper cargo block, and pass the pendant through the opening in the king posts and outboard to portside of the cargo hoist hauling part.
- Haul in on cargo falls until the boom head and cargo blocks rotate and the boom passes through the opening of the king post and repositions itself at 85° toward the adjacent hold.

- Reverse this procedure to move the boom back from the adjacent hold to the original hold.

The following precautions should be observed when working these jumbo booms.

- When swinging a loaded boom, swing the boom outboard of the ship slowly while observing the topping lifts and ship's lift.
- Do not swing boom outboard beyond 70°

from the ship's centerline or beyond a point where the boom's outboard topping lift shows evidence of slackness.

- When shifting the boom between holds, station an observer on the ship's centerline to assist the winch operator in keeping the boom centered between the king posts (within 3°, port or starboard). Take care not to overload topping lifts as the boom nears the vertical position.

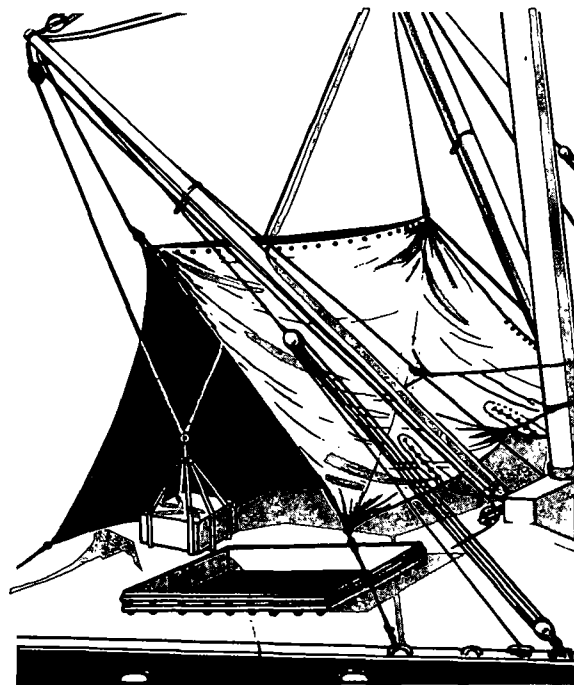
HATCH TENTS AND SAVE-ALL NETS

HATCH TENTS

Hatch tents are large canvas shelters that are suspended from the heads of the booms to protect cargo and men during inclement weather. Hatch tents are frequently used in areas which have a rainy climate. They are also used for shade during extreme heat, especially when discharging refrigerated cargo. Hatch tents give only partial protection, so when work is discontinued, close and batten the hatch to give the cargo better protection. The Seattle hatch tent shown here is the best all-purpose hatch tent, because it completely covers the hatch.

The steps used in rigging a hatch tent are as follows.

- Secure the gantline to the head of each boom. The gantline is a length of rope, 3½ inches in circumference, which is reeved through a 10-inch wooden block secured to the link band at the head of each boom. These blocks hang on the offshore side of each boom.
- From the wharf, make sure that both blocks appear on the sides of the booms away from the wharf.
- Hoist the tent aboard ship using the ship's fall.
- Tie the hatch boom gantline to the large shackle attached to the metal shoe in the rear peak of the tent. The tent should be spread out while it is being raised with the inboard fall. The hatch runner is in-



serted in the opening between the ridges of the tent, and then the hatch gantline is heaved up until the bottom of the tent is above the deck. The heavy backstay of the tent is pulled taut, and the gantline is secured.

- Hoist the front of the tent by using the gantline. Hoisting is continued on the gantline until the ridge of the tent is straight and parallel with the deck.

- Secure the outboard gantline.
- Spread the tent over the hatch opening. Secure and tighten guy lines on the corners and center of the sides and back. Adjust intermediate lanyards to keep the tent straight and to prevent sagging.

The Seattle hatch tent is designed with reef points and laced-up flaps so that it can be adapted to hatches of practically any size. The flaps are unlaced to form a protective shelter for the winchmen.

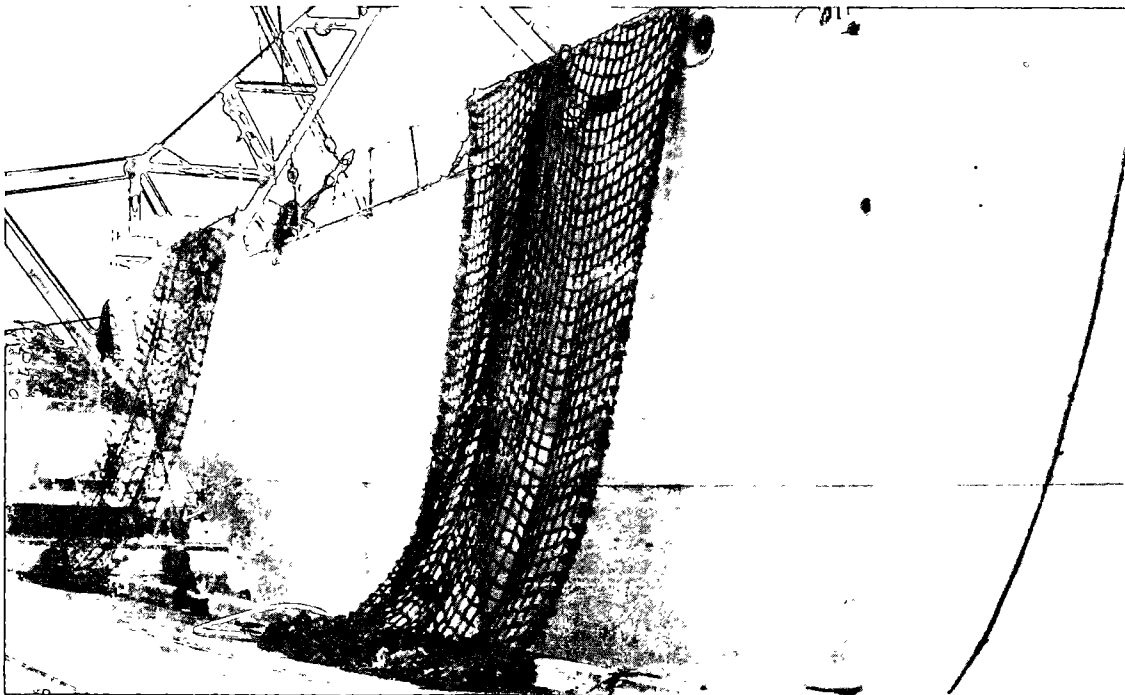
SAVE-ALL NETS

Save-alls are used to prevent the loss of cargo overboard during loading and discharging. They are rigged at each working hatch and beneath each gangplank, skid, or conveyor. The most common type of save-all is a rope net. The type found in the general hatch is made of manila rope and is 20 by 40 feet, with an 8-inch square mesh. If a standard save-all is not available, substitutions are made. For example, wire or rope cargo nets can be lashed together, or wooden platforms can be constructed and made fast between the ship and the pier under the working area.

The normal method of rigging a save-all is to use the ship's falls to:

- Hook the top center of the net and then hoist it until even with the ship's rail
- Secure the lanyards or lashings to cleats on board and slack off the net.
- Secure the bottom of the save-all to the stringer on the pier.

Sufficient slack should always be left in the save-all to prevent it from being carried away when the tide or current moves the ship higher or lower or away from the pier. Where extremely high tides are common, the lashings should be slacked off or tightened frequently during the change of tide.



NEW DEVELOPMENTS IN SHIP'S GEAR

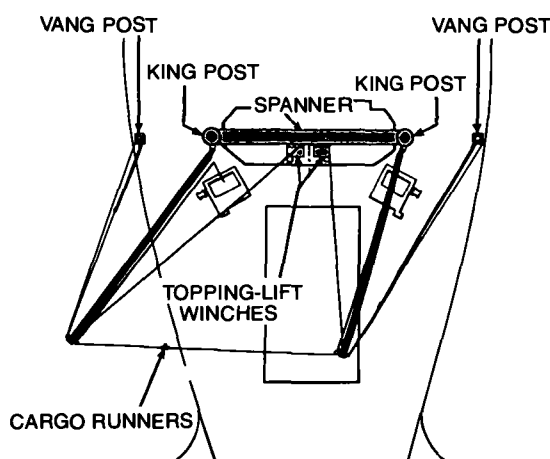
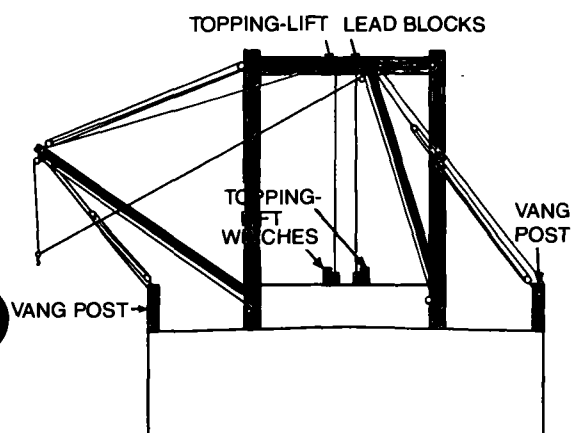
FARREL RIG

A major improvement in the yard-and-stay method of rigging the ship's gear for Burtoning cargo has been made in recent years. This method involves the use of the Farrel Rig. This method consists of placing the heels of the outboard guys or vangs on a common axis or making them coaxial. Topping-lift winches are installed and the hauling part of the topping-lift is reeved through lead blocks secured near the ship's centerline.

Once the guys have been secured to the short vang posts and pulled tight, there is no need to

tend guys. The boomhead moves vertically along a straight line parallel to the centerline of the ship. With this setup, all that must be done to top or lower the boom is to press the button controlling the topping-lift winch.

The addition of vang winches makes this rig more useful. With the guys led to power, it is possible to swing the boom in either direction under power, thus providing complete power positioning of the unloaded boom.

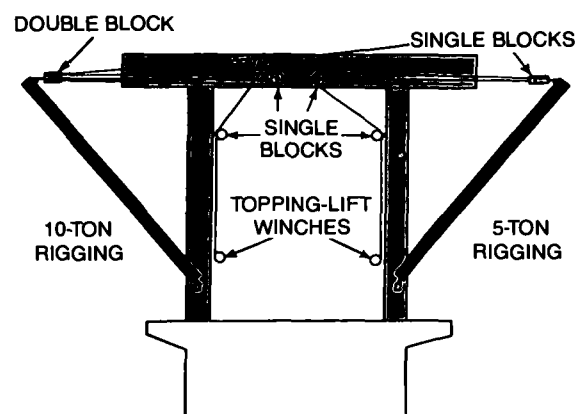


EBEL RIG

The Ebel rig was designed to:

- Handle loads up to the full capacity of 5- and 10-ton booms by the Burton system
- Provide for complete power positioning of the unloaded booms
- Eliminate manual handling of lines
- Increase safety.

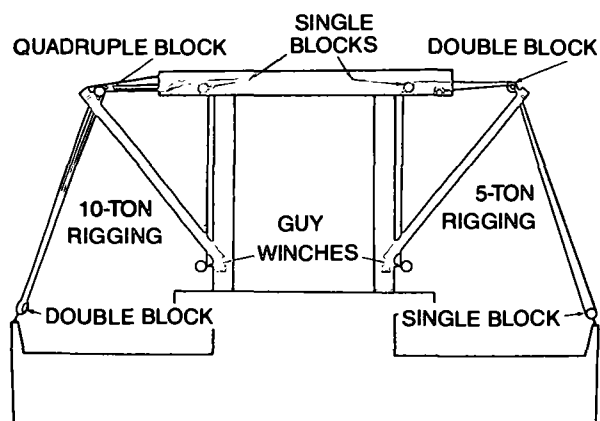
The illustration shows schematically the arrangement of the topping lift on the 5- and 10-ton booms. The topping lift is offset inboard near the centerline of the ship to control the swinging of the boom in the outboard direction. The hauling part of the topping lift is led down the inboard



side of the king post through a leadblock to the drum of one of the topping lift winches mounted on the king post.

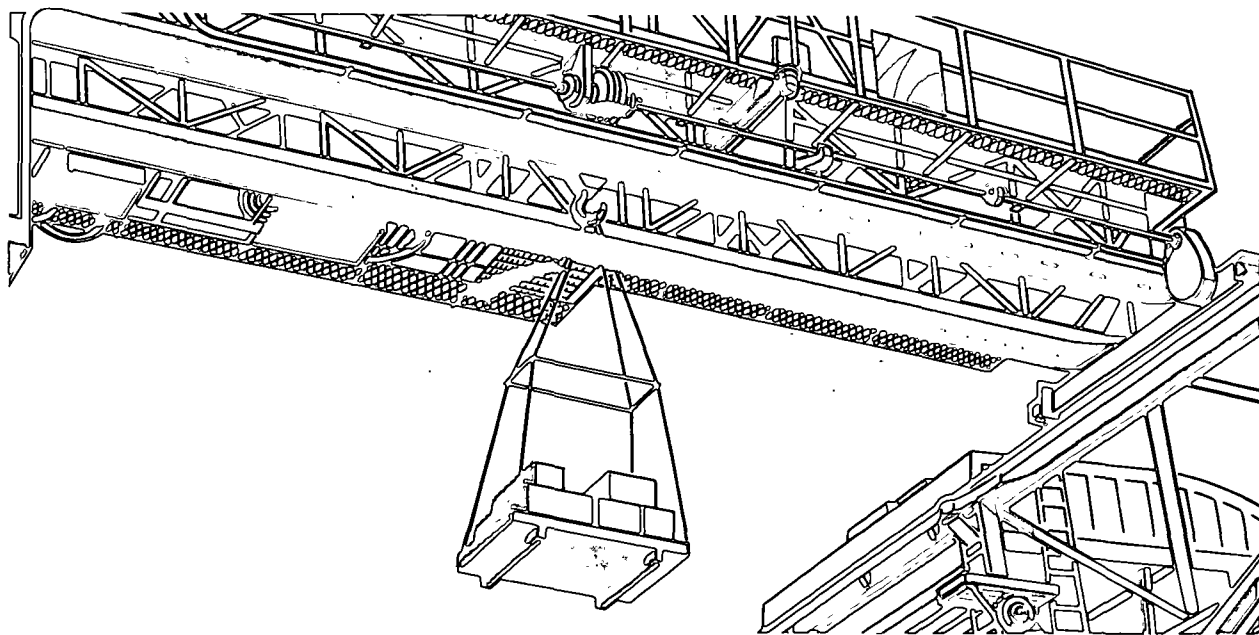
Here you see the arrangement of the mechanical guys on the 5- and 10-ton booms. When rigging the 5-ton boom, the standing part of the guy is secured to the extreme outboard end of the crosstree and runs over a sheave at the head of the boom, down to a sheave at the bulwark, back around the second sheave at the head of the boom, through a leadblock, and then down the outboard side of the king post to the drum of the electric guy winch mounted on the king post. No vang posts are necessary because the guy is secured to the deck or bulwark.

The Ebel rig is designed so that the effective guy resultant force keeps the stresses moderate, even when 5- and 10-ton loads are being handled. If the draft is hoisted to excessive heights, the outboard boom head rises by riding up the bight of the guy tackle until it reaches a position of equilibrium with the load. While the boom head rises, the draft remains almost stationary. The angle between the two falls is thus limited to a



fixed predetermined maximum, and no part is overloaded. When the draft is lowered by slackening off on the falls, the boom resumes its normal position by riding down the bight of the guy. Since the boom is never free from the tensioned guy, it cannot drop freely. When moving (Burtoning) 5 tons, the minimum height of the married fall above the deck at which the outboard boom will ride up is about 30 feet. For lighter loads, it is higher. The drift is ample to handle almost any draft.

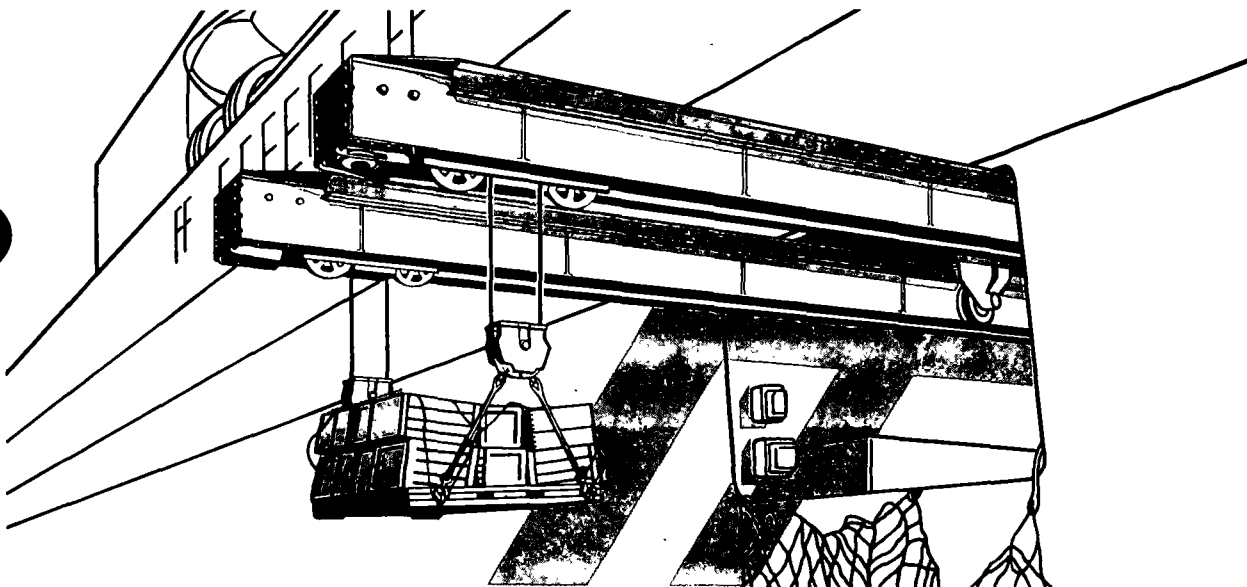
CARGO HANDLING CRANES ABOARD SHIP



During recent years, the military services and commercial steamship companies have been using shipboard cranes to replace the yard-and-stay rig in some instances. Since the crane operators are part of the ship's crew, military personnel would not normally be required to operate these cranes.

There are three principal types of cranes which military cargo handlers might be called upon to operate:

- A crane mounted on the centerline of the vessel between two hatches, and capable of working the ends of both hatches or with a combination of crews, working one or more hatches.
- An overhead crane mounted on trucks which run forward and aft paralleling the centerline of the ship. The crane extends over the side of the vessel. When the draft is hoisted to the desired height, it is moved athwartship on a beam-type trolley.
- A side port crane mounted to the overhead of the 'tween decks. This crane boom can be extended over the pier. The draft, which is hooked up by means of short bridles, is hoisted to the height of the side port opening and then across the vessel by a trolley.



SUMMARY

You may be required to load or discharge vessels at any port in the world. While working at foreign ports, you may be required to rig ship's cargo gear of some very old and some very new vessels, some of which were not discussed in this

chapter. However, if you have a thorough working knowledge of the rigs discussed in this chapter, you will find that all ship's cargo gear is basically the same.



11



12



CHAPTER 5 LOADING AND DISCHARGING GENERAL CARGO VESSELS

SOS – the SAME OLD STUFF! Load one today and unload one tomorrow. That's the attitude taken by some newcomers to ocean terminal operations. The veteran cargo handler, however, knows that there's a whole lot more to it than that. Each ship and its cargo presents a different challenge. Each ship has its own unique difference, and cargo has its own problems. The more you know about loading and discharging procedures and the more experience you have in your field, the more effective you can be. This means you are more ready to accept the challenge of that ship appearing on the horizon.

In this chapter we will talk about how to get cargo into the hold and what to do once you have it there. Specifically, we'll discuss how to place the cargo to keep it from shifting or otherwise damaging itself or the ship or other cargo. We'll also talk about how to get certain kinds of cargo aboard the vessel and how to stow it. After all, you handle a tank differently from a load of lumber. In this chapter we'll also cover how to watch for and prevent cargo damage as well as what to do with cargo once it has been unloaded.

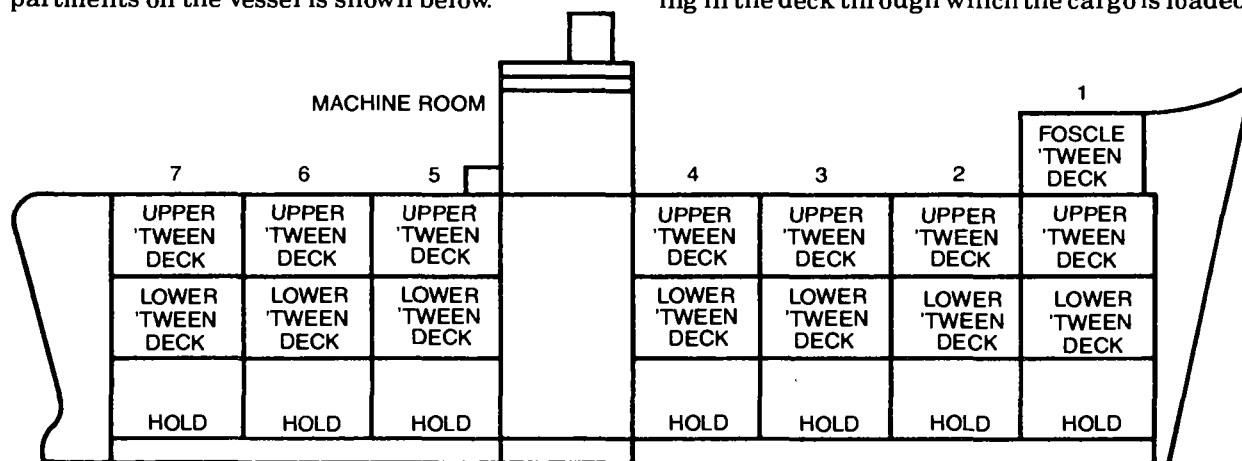
CARGO HOLD COMPARTMENTS

Here, we are interested in two things: cargo compartment terminology and how to open and close five different types of covers.

TERMINOLOGY

For stowing cargo, a cargo handler is basically concerned with space on the upper 'tween deck and with deck levels below it for hold stowage. An example of the location of the cargo hold compartments on the vessel is shown below.

When referring to cargo compartments, sometimes you'll hear the terms *hatch* and *hold* used to mean the same thing, but in strict terminology there is a great difference. The *hatch* is the opening in the deck through which the cargo is loaded



CARGO HOLD COMPARTMENTS, MARINER SHIP

or discharged. The *hold* is the lowest compartment under the hatch. It is normally used to stow cargo. In general terms, the area directly below the hatch is called the *square of the hatch*. The areas under the 'tween deck are called the *wings*. A wing on the left side of a ship is called a port wing and on the right side it is called a starboard wing. The wing toward the bow is the forward wing and the wing toward the rear or stern of the ship is called the aft wing. This chapter will refer to names that apply to both hatch and hold compartments.

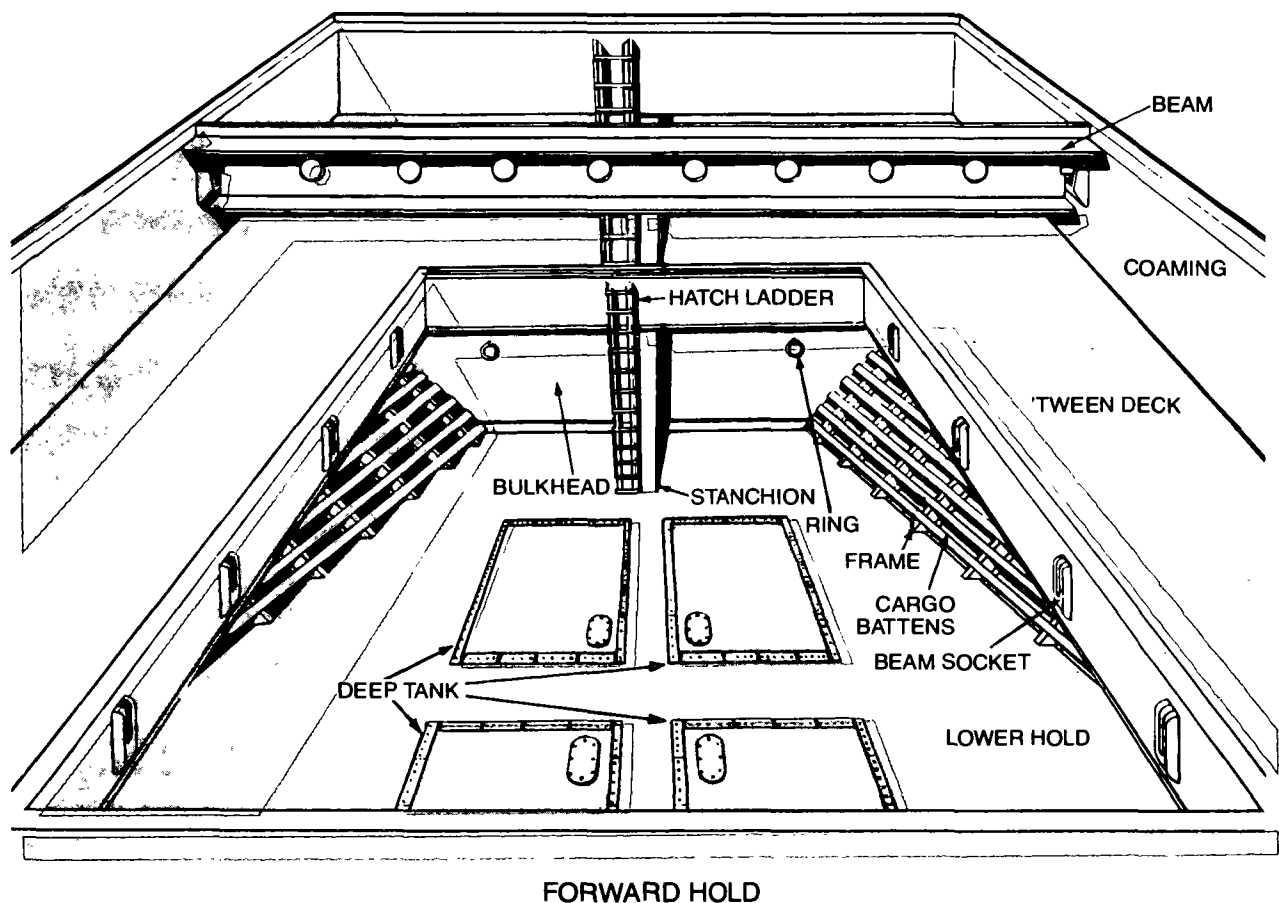
Cargo compartments are numbered beginning at the bow. The numbers progress as they go toward the stern. The number of cargo compartments will vary depending on the size or type of ship.

Before stowing cargo in a hold, you should be familiar with the names and purpose of the various parts of the hold and the fittings and equipment. Note here the ship's forward and aft holds with some of the names and parts you should know.

The **beam socket** is a steel fitting riveted or welded to the inner surface of the hatch coaming to support the ends of the hatch beam.

A **bulkhead** is any vertical partition, whether fore-and-aft or athwartship, that separates one compartment or space from another.

Deep tanks are portions of vessel's lower hold partitioned off and constructed to carry liquid cargo, ballast, or dry cargo. They are bound at each end to reinforced watertight bulkheads and at the top by a watertight steel deck.



Frames are girders to which the outside plating is secured. They form the ribs of the hull and extend from the keel upward along the inside of the hull to the highest continuous deck.

A **hatch beam** is a portable beam that runs across a cargo hatch and supports hatch boards.

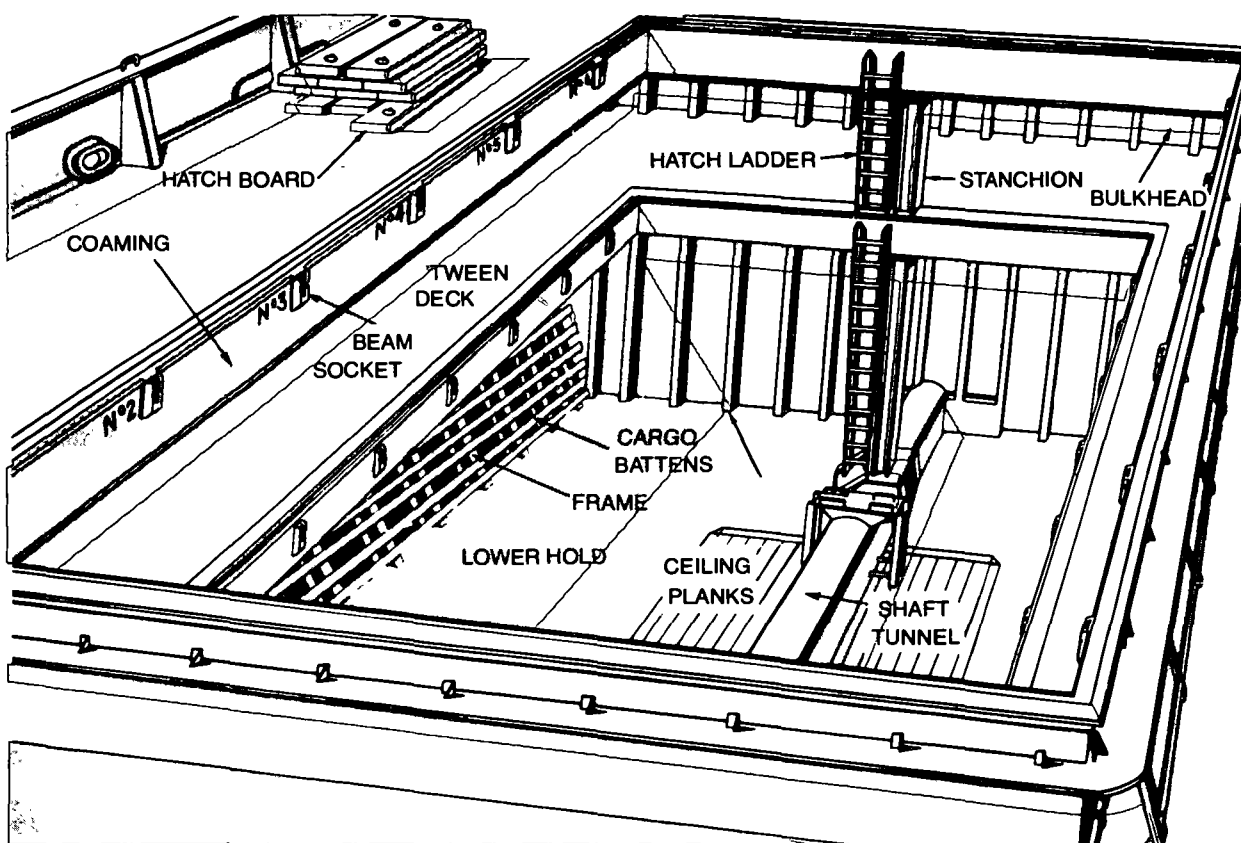
Hatch boards are wooden boards about 4½ feet long, 2½ feet wide, and 2 or 3 inches thick, usually reinforced with metal at the ends. Most hatch boards have recessed handles or rings at each end to permit easy handling. Hatch boards are supported by hatch beams and serve as hatch covers.

The **hatch coaming** is the plating built around a hatch to serve as a framework for the hatch beams and hatch covers, to secure the tarpaulins, and to prevent water from seeping into the cargo hold.

A **ring** is a fitting attached to the pad eye to which lines may be secured in moving cargo in the hold.

Stanchions or pillars are the upright beams supporting the decks. In addition to providing deck support, they transmit weight toward the bottom of the hull and distribute it over a large area. They also help to tie in the decks, frames, beams, and girders. This makes it a complete unit.

Pillars may be circular, octagonal or H-shape. Circular or octagonal pillars may be hollow or solid. Their size depends upon the load that the pillar is required to support. Each pillar has a head or cap plate at the top and a spring or sole plate at the bottom.



AFTER HOLD

OPENING AND CLOSING HATCHES

When discussing how to open or close hatches, it is necessary to examine the different types of covers that may be found from one ship to another. Five types of covers that Army cargo handlers use are the **board and beam**, **pontoon**, **folding metal**, **hydraulic**, and **insulated**.

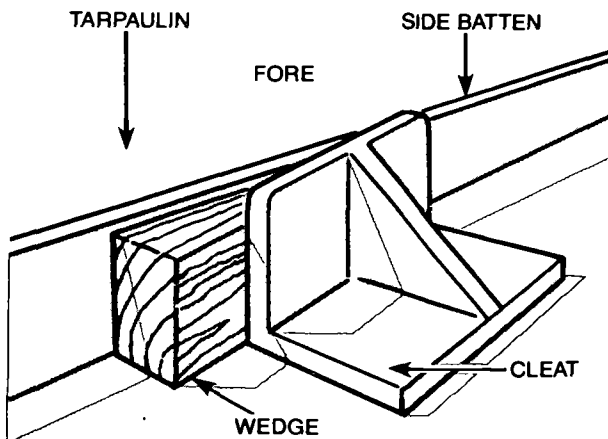
The covers provide a watertight closure for the hatch that is strong enough to support deck cargo and withstand the weight of sea water that may wash over them.

BOARD AND BEAM HATCH

This type of cover requires the most work and longest time to open and close.

In makeup, a series of steel I-beams are set into the coaming across the hatch. The coaming is the raised portion around the hatch that keeps out water. The beams support boards or planks, at least 2 $\frac{3}{4}$ inches thick, which fill the spaces between them. Over the boards, sometimes called hatch covers, are three separate layers of No. 4 heavy canvas. These tarpaulins cover the entire hatch to make the cover watertight.

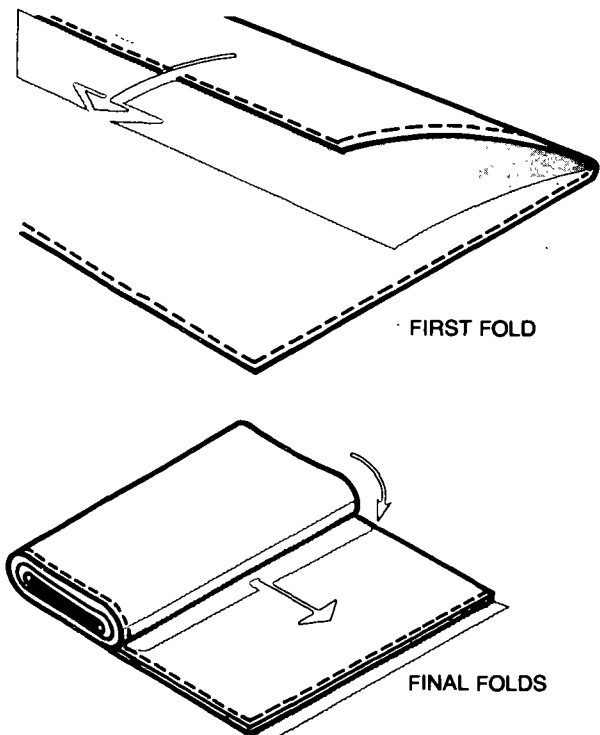
To keep them in place around the sides of the coaming, steel bands called side battens are set over canvas between the coaming and a series of angled steel cleats into which wooden wedges are driven. Notice how the wooden wedge on the



board and beam hatch is driven between the side batten and cleat, and the blunt end of the wedge toward the bow. This is so that the force of the waves will drive them tighter. They might be worked loose by a heavy sea if the points were driven toward the bow. To finish the job, a number of steel bands called cross battens run across the top of the tarpaulin. Some of these bands are clamped or bolted down at their ends under the edge of the coaming. Others, made of two pieces, just hook under the edge of the coaming at either side of the hatch. They are tightened by a turnbuckle at the center.

The three major steps in opening a hatch of the board-and-beam type are removing the tarpaulins, removing hatch boards, and removing the beams. Let's see how it is done.

Loosen and remove the cross battens, knock out the wedges and remove the side battens, collect the battens and wedges in separate groups, and store them out of the way. When the tarpaulins are free, fold them up.



Start the men at one end, preferably the end nearest the winches to be worked, and draw the tarpaulin back until it is folded in two, lengthwise. Next, starting at the fold, repeat the process, folding the tarpaulin in quarters. Fold the tarpaulin until the end of the hatch is covered by a strip 3 or 4 feet wide. Then, starting at the side of the deck over which the cargo is to be worked, make the final folds athwartship. Remove the folded tarpaulin from the hatch and stow it in a rack or on dunnage, clear of the hatch. Repeat the process for the other two tarpaulins, stacking them on the first. Then remove the hatch boards.

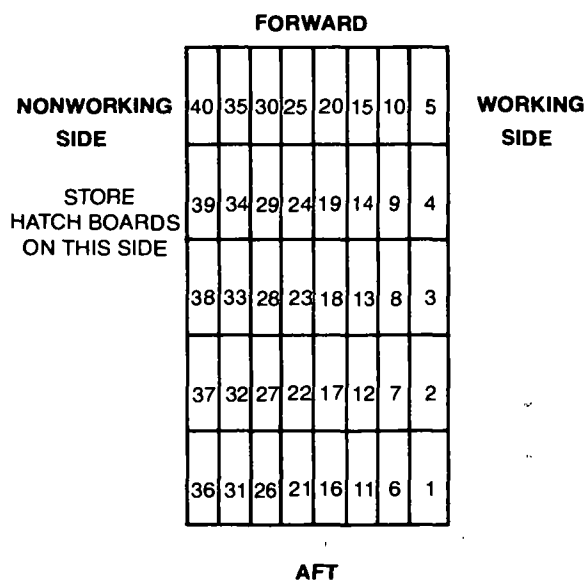
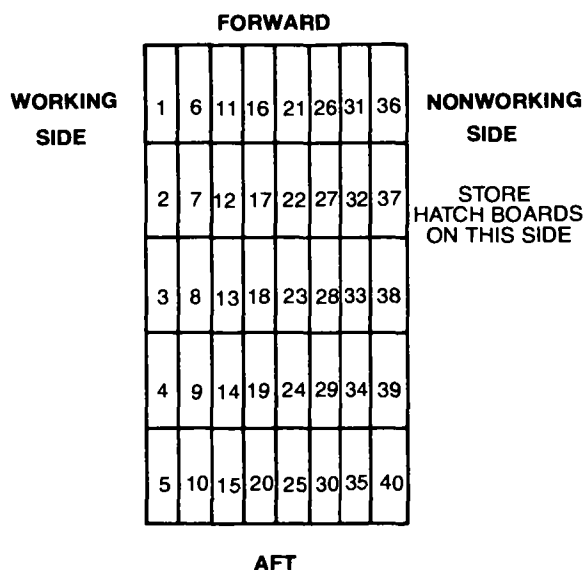
Begin removal of hatch boards at the inshore (working) side of the vessel and remove them to the offshore (non-working) side, so that the men removing the hatch boards will have a firm footing at all times.

Remove the hatch boards in the sequence shown in the top figure, if the vessel is to be unloaded from the port side.

Remove the hatch boards in the sequence shown in the lower figure, if the vessel is to be unloaded from the starboard side.

Hatch covers should be stacked not closer to the hatch than 3 feet and no higher than the hatch coaming.

Stacks should be neat and solid. Remove the hatch boards by using two-man teams. Two men from the team get up on the hatch and remove the boards. This is done from the working side to the non-working side of the hatch, working either from the fore or aft of the hatch. The hatch boards are gripped at the hand-holds in the diagonal corners. The two men then pass them to the other two men of the team who stand on deck and stack the boards out of the way. The last lengthwise row of boards must be handled from the deck, so all four men in each team remove these boards. Because boards are frequently warped and twisted, they fit best in the places from which they were removed. So stack them in some particular grouping or order to be sure that they will be replaced in their original position. It is well to have the ship's crew number the hatch boards so that each can be put back in its place. With the

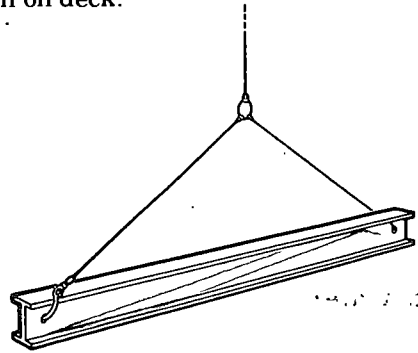


hatch boards removed and carefully stacked well clear of the working area, all that remains is to remove the hatch beams.

Hatch beams are steel I-beams running across the hatch and set in sockets in the hatch coaming. Hold them in their sockets by some kind of locking device to keep them from being accidentally dislodged. This device is especially important when working a partially open hatch. The locking devices prevent a draft of cargo from accidentally dislodging a beam. Be sure to check carefully for locking devices and free them before trying to remove hatch beams.

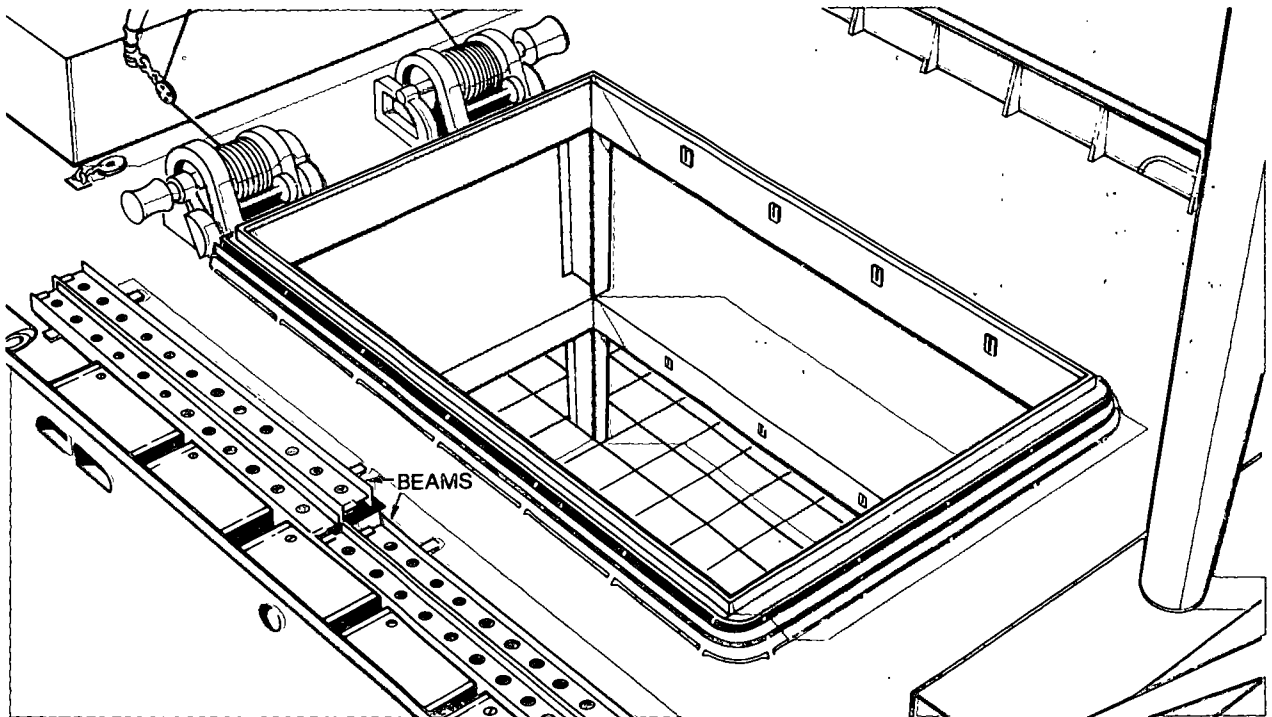
After beams are unlocked, remove them from the coaming by winch power and a special rig called a beam bridle. Be sure the hooks are set in the beam in a balanced state. This insures the beam against slipping. A simple rule to follow is to have both men hold the hooks in their right hands. Since they face each other across the hatch, the hooks will be inserted from opposite sides of the beam. Also, attach a tag line to the beam bridle to keep the beam from swinging.

This is so the beams can be moved to the desired position on deck.



To stack the beams, lift them from their position in the coaming and land them on the side of the deck opposite that from which cargo is to be worked. Lay them on their sides for safety. Set dunnage to make it easier to pick them up when they are to be returned to the coaming.

Always replace the beams in the same sockets where they were removed. Mark and number them for identification. If you do not mark them, be sure to stack them in a regular arrangement.



HATCH READY FOR CARGO TRANSFER OPERATIONS

On vessels equipped with roller-type hatch beams, tarpaulins and hatch boards are removed as described above. However, it is not necessary to remove the beams. When all boards have been removed, the beams are rolled to either one or the other end of the hatch.

PONTOON HATCH COVERS

Many vessels are fitted with pontoon hatch covers that are constructed of welded steel. This forms a series of box girders about 12 inches deep over the hatch. At each corner of the pontoon is a special casting in which a hook can be inserted. The pontoons are seated on a rest bar of flanged plating welded to the inside of the coaming about 12 inches from the top.

To open this type of hatch:

- Remove the tarpaulins the same way as described above.
- Hoist the pontoons out the hatch opening and stack on the side opposite the working area.
- Lay strips of dunnage on the deck and between the pontoons when they are stacked.

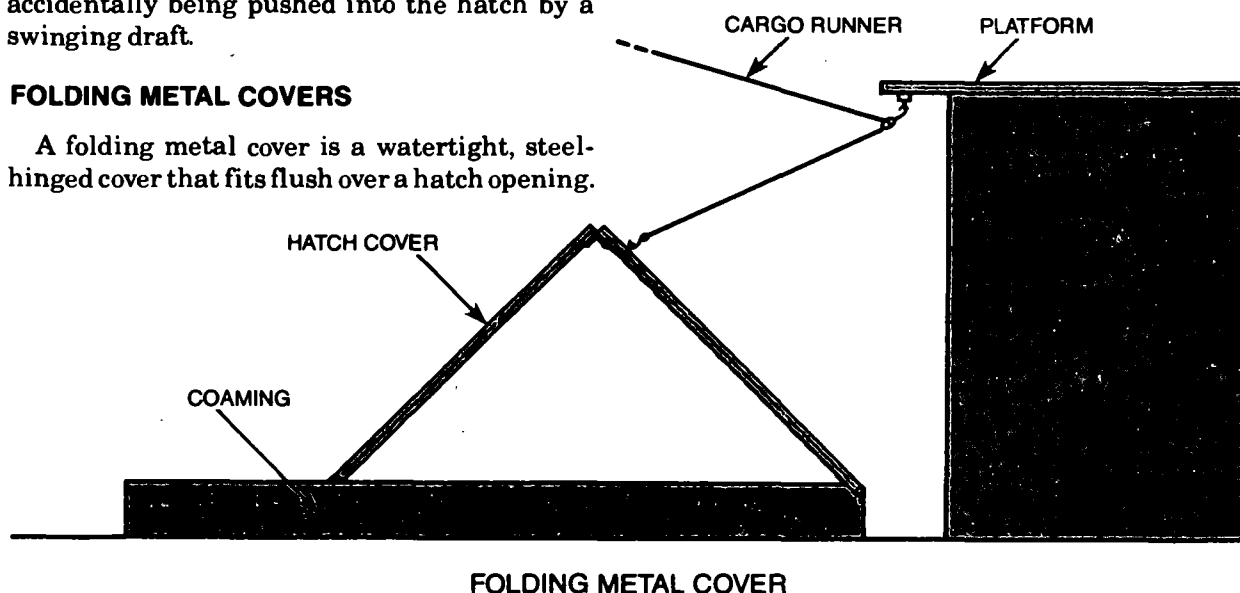
Never stack pontoons higher than the coaming, to prevent the possibility of the pontoons accidentally being pushed into the hatch by a swinging draft.

FOLDING METAL COVERS

A folding metal cover is a watertight, steel-hinged cover that fits flush over a hatch opening.

A gasket of soft rubber around the outer edges and neoprene, a rubber-like plastic, at the center and intermediate joints of the cover make it watertight. One reason for developing this type of covering was to further reduce the time required to open hatches. This objective was reached because with such covers, a hatch can be opened in as few as 5 minutes after the screw locks have been released. With the other types, it takes 30 minutes to an hour after the wedges have been removed. Another reason was to cut down the number of accidents. Since opening a folding metal cover is simpler and involves fewer steps than the other types, the accident rate is lower. Also, the working area is safer, since covers are drawn up to the ends of a hatch rather than put on deck.

The winch control platform plays a part in raising and securing the covers. It also elevates the winches and gives the operator a clear view of the signalman when the cover is being opened. Winch power, normally with cargo runners, is used to open the hatch. The runner is reeved through a block attached to the platform or through a sheave embedded in it. It is then hooked or shackled to the center of a section. With the cargo runner thus rigged, the section is pulled up and back to the control platform and secured there with chains.



The following procedures should be followed when opening this type of hatch.

- Release screw locks around the coaming and athwartship at each section.
- Turn down the eccentric (off-center) wheels on the sides of the section so that they will bear the weight of each section as it is being opened.
- The hatches are equipped with jacks for raising the section high enough to seat the eccentric wheels properly. When a section is jacked up a few inches, the pins in the wheels are changed from the off-center to the center position to place the weight of the section on the wheels to protect the gasket. The gasket would be ripped out during opening or closing if the sections were not raised with jacks and supported by the wheels.

HYDRAULIC COVERS

Hydraulic covers are probably the most significant development along these lines in the last 25 years. They come in four hinged sections and fold up accordion style, leaving a clear hatch opening. Since hydraulic covers are opened in about one minute by one man who flicks a lever conveniently located on deck near the hatch, this type of cover saves time and costs. Because of the ease with which hydraulic hatches can be opened and closed, they give greater protection to perishable cargoes in cases of foul weather. Also, valuable cargo can be safeguarded by closing the hatch when it is to be left unattended.

INSULATED HATCH COVERS

Refrigerated ships have insulated hatch covers. Older types are called plugs and are designed like the pontoon hatch covers previously

discussed. These covers are thick and air-tight with their tapered edges lined with insulating material. They are fitted into beams spanning the hatches. The plugs are fitted with rings or slotted ends to which a bridle can be attached to remove the covers rapidly. This type of hatch cover is covered with tarpaulins and battened down. Newer insulated hatch covers are the folding, self-sealing type.

Before a vessel sails, securely close the hatches to protect cargo in the hold from sea, wind, and rain. Hatch beams and boards, pontoons, or folding hatch covers are replaced in the reverse order of that in which they were removed. Special care should be taken when replacing tarpaulins. Normally the cargo handlers close the hatches and spread one tarpaulin over the hatch. The ship's crew completes the battening down.

SAFETY PRECAUTIONS

Here are some safety precautions to be observed when working around hatches.

- Never leave hatches unguarded.
- Don't pile up hatch boards alongside an open hatch. Pile them along the ship's side.
- Do not throw tarpaulins over hatches where no boards are in place. This could cause serious injuries.

To prevent accidents:

- Preserve a 3-foot space around 'tween deck hatch openings as a safety area for walking, piling hatch beams, and stowing hatch covers.
- Put a lifeline or rope fence in the 'tween deck when the lower hold is open.
- Close hatches when cargo is not being worked.

GENERAL RULES FOR STOWING CARGO

Common sense plays a role in the wise use of space. For example, stowing cargo is much the same as when you travel and have to fit as many of your belongings as possible into a large suit-

case. If you are sure that nothing you plan to put into the case will make it too heavy to handle, you fit as much as possible into the space you have — cushioning fragile items and packing all items

tightly to avoid breakage. One of the objectives of proper stowage is to make sure that cargo arrives at its destination undamaged. A second objective is to put as much as you can in the available space.

Important actions you can take to reduce cargo damage are listed below.

- Insure the cargo hold area is clean before stowing cargo. If the hatch is not cleared, pieces of wood from broken crates may get under the pallets when they are put into the storage position. A lopsided pallet may cause the whole shipment of cargo to shift when the ship is at sea. Stow cargo so that the strongest structures of an item will bear the greatest pressures and weights of that item.
- Use dunnage only in required quantities.
- Stop cargo damage by following instructions on labels such as **USE NO HOOKS, THIS SIDE UP, DO NOT DROP**, etc.
- If it is necessary to walk on top of or land

drafts on cargo such as cardboard cartons, lightly constructed cases, bags, and crates, place a layer of dunnage over the cargo to protect it from damage.

To obtain maximum use of the carrying capacity of a hold, broken stowage should be minimized. This is accomplished by:

- Careful prestowage planning so that cargo will fill the hold without leaving large empty spaces.
- Proper supervision during loading to insure correct stowage and fit of irregularly shaped packages.
- Maximum use of filler cargo where empty space occurs.
- Nesting of cargo to use space that would otherwise be wasted.
- Avoiding excess dunnage.
- Using dunnage for false decks to permit additional stowage.

SECURING CARGO

Considerable force is put on cargo at sea. This makes it difficult for cargo to remain in its stowed position. The shifting of cargo during a voyage results in considerable damage to cargo and ship. Good stowage practices include the proper use of lashing and dunnage. Other means of securing cargo include shoring, tommying down, blocking, and bracing.

All deck cargo must be lashed, in addition to shoring, blocking and bracing. Cargo stored be-

low deck can usually be secured from shifting by shoring, blocking, and bracing with timbers firmly wedged and nailed or lashed.

The securing of cargo is especially important when a vessel is sailing in convoy and the master is not permitted to alter course or speed to avoid rough seas or foul weather. Since convoy sailing also exposes deck cargo to greater hazards, particular attention should be given to the type, strength and number of the lashings.

LASHING DECK CARGO

Lashing is the means of securing vehicles and other cargo by using wire ropes, chains, steel bars and turnbuckles.

LASHING MATERIAL

Selection of lashing materials is governed by their availability and the type of cargo to be secured.

- Wire rope, $\frac{5}{8}$ inch in diameter, is used most frequently for heavy cargo and large items.
- Chain is often used for securing lumber and extremely heavy objects on deck. The most common size chain is $\frac{3}{4}$ inch in diameter. Wire rope may also be used for this type of cargo.

- Steel or wrought-iron bars are exceptionally good for securing boxed or rectangular cargo.
- Steel strapping is also used for lashing.
- Turnbuckles or other tightening devices are used with all types of lashing to permit tightening enroute.

BASIC LASHING PROCEDURES

The method used to lash cargo will vary because of the different types, sizes, and shapes of the cargo that must be shipped. Following are some of the procedures used to secure cargo.

- Pass one or more lashings over the top of the item. This method is the least desirable because it is most ineffective for opposing centrifugal force. The cargo simply slides back and forth under the lashing.
- Pass two or more lashings completely around the item. This type of lashing provides greater resistance to the forces exerted athwartship. It prevents the cargo from moving without exerting strain on the lashing. This is the more effective of the two methods.
- Combine one of the above methods with dunnage or saddles at each corner. This prevents the lashing from cutting into the cargo.

Lashing is ineffective or it may even be harmful in itself unless the following facts are taken into consideration.

USE OF DUNNAGE

Although the term *dunnage* ordinarily refers to planks and pieces of wood, it may be any material used to protect a vessel and its cargo. Remember that good stowage is impossible without carefully applied dunnage. The following guidelines cover the uses of dunnage, dunnage materials, rules of good dunnaging, how to measure dunnage, and removing and storing dunnage material.

STORAGE

Lashing materials are stored in the port dunnage yard along with dunnage. Inventory control procedures are set up for these materials so that you always have them on hand when a vessel is ready for loading.

- All component parts of the lashing material are of approximately equal strength. Since the tension that the lashing bears is governed by the weaker part, it is a waste of material to use a turnbuckle half the strength of the wire rope.
- A lashing may cut into the cargo it secures if nothing separates the two.
- Use dunnage for protection if saddles are not available.
- Because a lashing exerts compression on the cargo it secures, extra bracing is necessary to prevent crushing.
- Winding a continuous length of wire rope around and around an item is a poor method because a break at any point will make the entire lashing useless. Again, use two or more lashings.

REMEMBER! For all types of lashing, wooden capping, angle iron, or similar items should be used to prevent wire ropes or chains from cutting through the edge of a case.

Dunnage is used to:

- Prevent cargo from shifting and chafing.
- Chock off and secure containers.
- Block off broken stowage and fill void space that cannot be filled with cargo.
- Protect cargo from contact with water or other liquids that may get into the holds.

- Provide air passages for effective ventilation.
- Provide spaces for air circulation in refrigerated holds.
- Distribute weight.
- Separate cargoes.

DUNNAGE MATERIALS

Almost any material can be used as dunnage. The materials most frequently used are discussed below.

- Rough lumber of the same thickness but of different widths and lengths is the most common type of dunnage. Rough lumber may consist of pieces of pine, hemlock, spruce, or similar woods.
- Paper is often used to protect cargo from dirt, dust, and moisture and to separate shipments.
- Burlap is often made up in rolls or squares and used in the same way as paper.
- Other materials may be used for dunnage, depending on the cargo to be stowed and the quantity of the material available.

Hard and fast rules for selecting and using dunnage are not possible because of the wide variety of cargo carried, differences in atmospheric conditions and the availability of dunnage material, etc. However, the following basic principles always apply.

- Never use green or contaminated wood that may harm the cargo.
- Carefully select the quantity and type of dunnage to correspond to the type of cargo carried.
- Place the bottom layers of dunnage so that any water in the hold can flow to the drains. This is accomplished by laying the first layer of dunnage so that it points toward the drains and the next layer in the opposite direction. Cargo is then stowed on the upper layer of dunnage.

MEASURING DUNNAGE

The lumber that you use aboard the vessel for the storage of cargo must be measured. The measurements obtained in inches and feet must be converted to board feet. This is the unit of measurement for lumber in the United States. This information is entered on the manifest for dunnage accountability. To convert inches and feet to board feet use the following formula:

1 board foot = 144 cubic inches.

Board feet = $\frac{\text{Length (inches)} \times \text{Height (inches)} \times \text{Width (inches)}}{144}$

This would be written as follows:

Board feet = $\frac{L(\text{in}) \times H(\text{in}) \times W(\text{in})}{144}$

The following represents the correct solution for a problem requiring lumber to be converted from inches and feet to board feet. It should be computed for a stack of 2x4 inch lumber. The lumber is 4 ft 8 in long with 48 pieces in the stack.

Length = 4ft 8in (4 x 12 + 8 = 56in)

Height = 4in

Width = 2in

$56\text{in} \times 4\text{in} \times 2\text{in} = \frac{224 \times 2}{144} = \frac{448}{144} = 3.11$

3.11 B.F. x 48 pcs = 149.28 or 149
Board feet in the stacks.

REMOVING AND STORING DUNNAGE

You normally remove dunnage from the ship during discharge unless you are told not to. While the cargo is being worked, dunnage is made up in drafts as it becomes available. When a draft is complete, it should be removed. This procedure will insure that dunnage is handled a minimum number of times aboard ship.

The drafts of cargo or dunnage are removed from ships in cribs constructed and used in the holds or in slings. The dunnage crib is constructed from blocking and bracing material. It

is 3 feet wide, 8 feet long, and approximately 4 feet high. It holds 80 to 100 board feet of dunnage. When a crib or sling load of dunnage has been discharged to the pier, the crib and/or dunnage are then moved by truck or forklift to the port dunnage yard. The crib (if any) is then returned to the ship for further use after the ship is unloaded.

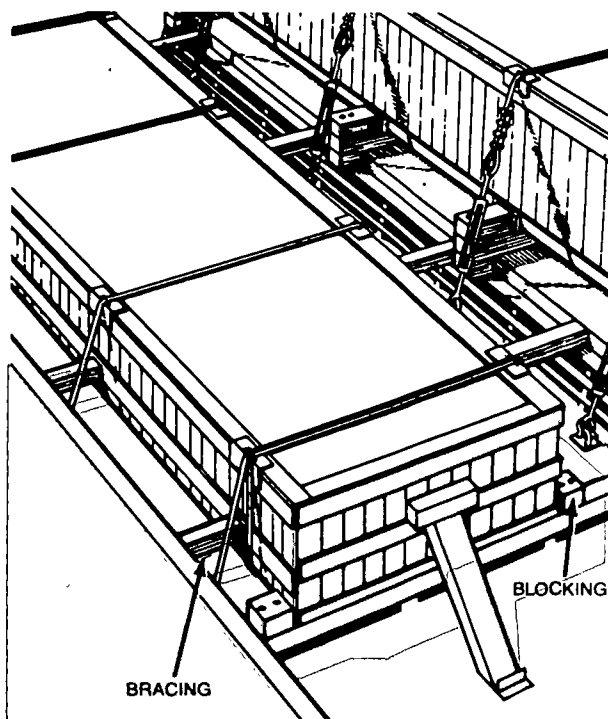
Once received at the port dunnage yard, dun-

OTHER MEANS OF SECURING CARGO

For many items of cargo, dunnage alone cannot insure that cargo will be held firmly in place during transit. Bracing, blocking, shoring, tomming, bulkheading, cribbing, and magazines are needed to stow tanks, locomotives, cranes, fuel drums, ammunition, and other cargoes. Let's take a look at these other ways of securing cargo.

Bracing is applying force against an item in a horizontal direction.

Blocking is placing timbers or blocks against the sides or ends of heavy lifts or vehicles to prevent horizontal movement.

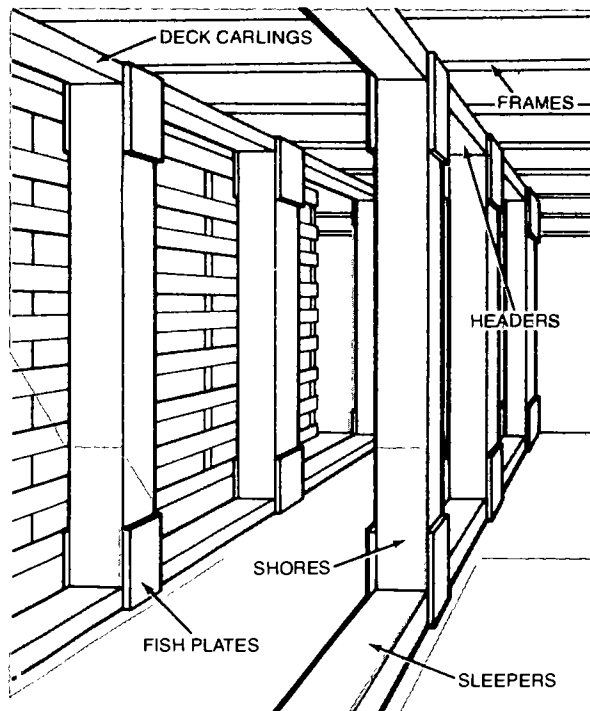


nage is immediately sorted and bundled according to size. The nails are taken out and the dunnage is stored and accounted for.

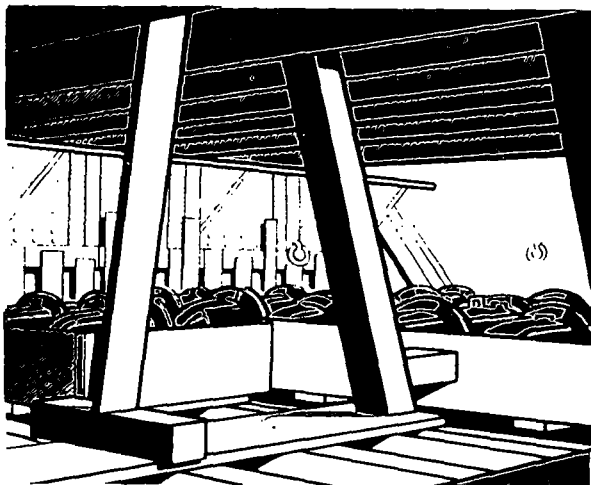
Stockage levels are maintained on inventory control cards in a visible index file.

Although dunnage varies in length, it is stacked with one end even to insure compactness and ease of handling and to allow room to work in the aisles.

Shoring is supporting objects by bracing them from below. Shoring in the 'tween deck and in the lower holds can increase the deckload capacity of the average ship about four times, making it possible for the main deck to carry loads such as locomotives weighing up to 12,000 pounds per square foot.



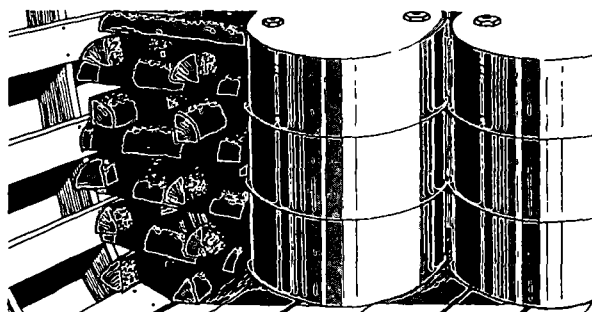
Tomming is bracing an item by holding it down from above. This method may be used when stowage space has not been completely filled. Also, it may be used where there is danger that the motion of the vessel might cause the cargo to shift.



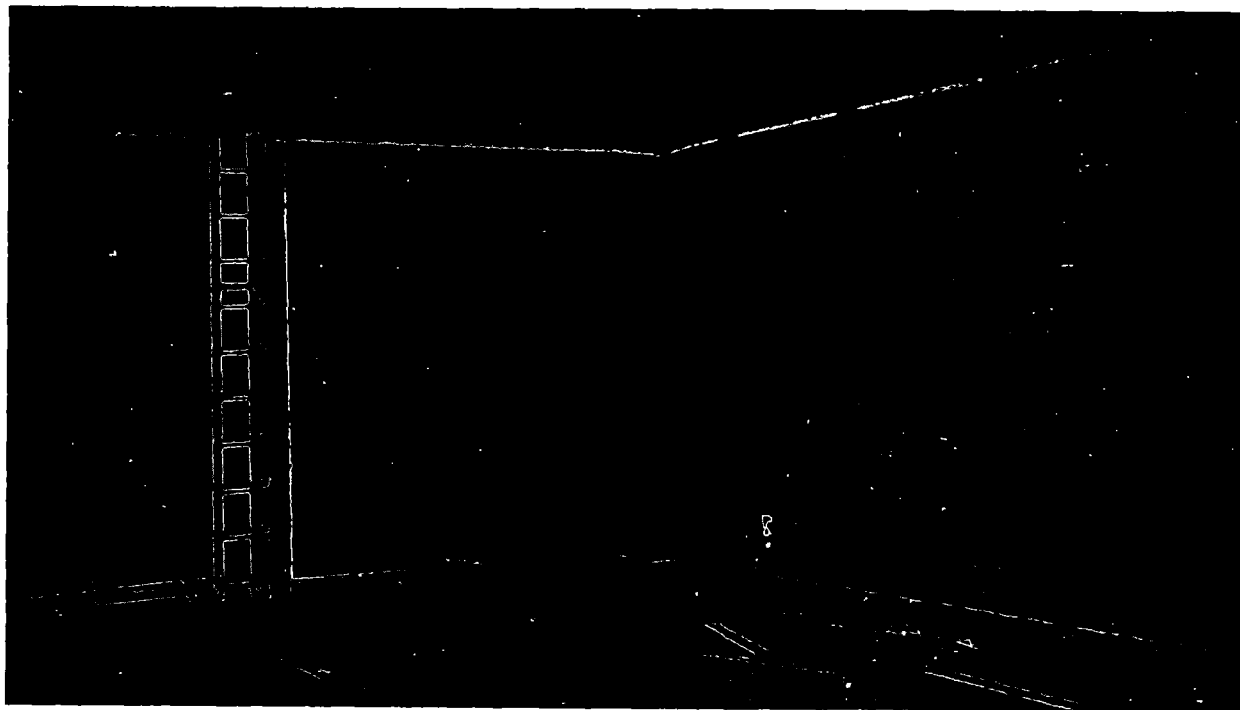
NOTE: The maximum effective length of timbers used for bracing, shoring, and tomming is equal to 30 times its minimum dimension. Thus, if a piece of timber is 4 inches thick and 6 inches wide, its maximum effective length is 10 feet ($4 \times 30 = 120$ inches or 10 feet).

Bulkheading refers to the use of vertical partitions made of dunnage to keep cargo from shifting or to keep it away from hot bulkheads

Cribbing defines the use of dunnage in the cargo compartment to eliminate void space. This type of blocking is called cribbing. Cribbing is used to fill vacant space as a precaution against shifting and to maintain a level tier so that other cargo may be stowed on top.



Magazines are special containers required by Federal and Coast Guard regulations for stowing certain classes of explosives. These containers, known as Class "A" magazines, insure adequate segregation and protection of the stow. They may be constructed of either steel or wood, depending upon the quantity and compatibility of explosives. For construction of these magazines refer to chapter 6 and TM 55-607.



STOWING DIFFERENT TYPES OF CARGO

Many types of cargo are stowed aboard the vessel. The methods used to stow cargo depend upon the type of cargo. This section discusses how to

stow nonunitized cargo, heavy lifts, refrigerated cargo, palletized cargo, and deck cargo.

NONUNITIZED CARGO

In today's revolutionized shipping society, cargo is shipped either in containers or in unitized loads for quick loading and unloading of the vessel. However, circumstances may dictate cargo being loaded aboard a vessel in a nonunitized configuration. When this happens, the terminal operation coordinator is the person who must load and store the cargo. Nonunitized cargo load is one packaged item shipped as a unit - such as one bag of cement.

BAGGED CARGO

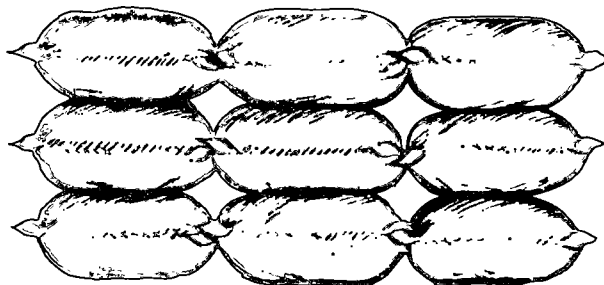
Bagged commodities such as cement are subject to damage if stowed close to moist cargo or cargo that may sweat. Protect bags from direct contact with metal. Use mats, paper, or other protective material to protect the cargo from moisture running down the ladders, frames, stanchions, etc. When bagged cargo is loaded aboard a vessel on which no dunnage is used between the bags and the wooden cargo battens, stow the bags on their ends in the wings of the ship to prevent them from protruding over the battens and coming in contact with moist metal and hull platings.

Do not allow the bags to overlap the stringer plates of beams or similar obstructions in the hold. If the bags were allowed to overlap, the motion of the vessel could cut the bags. Vertical dunnage against ladders and hatch battens will normally protect the bags from falling or chafing. Never use hand hooks to handle paper-bagged cargo.

Bagged cargo in large lots is stowed in tiers across the hold. There are three general methods for stowing bagged cargo:

- The full bag method provides good ventilation.

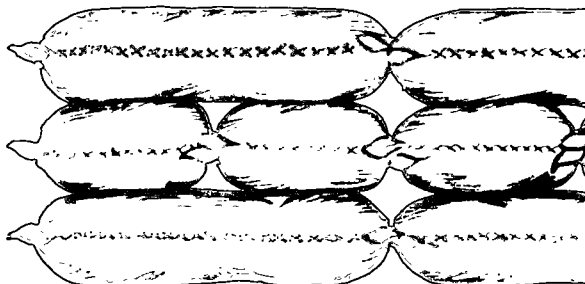
- The half-bag method is used where floor ventilation is not important and bags are soft.
- The cross-tier method is used at corners and at outer rows to prevent collapsing.



FULL BAG METHOD



HALF-BAG METHOD



CROSS-TIER METHOD

The figure at the top of page 5-15 shows a typical stowage of bagged cargo. Dunnage around the ladder protects the bags. The bulkheads prevent shifting, and the cross-tier method of stowing prevents collapsing.



BALED CARGO

Baled cargo is a large closely pressed package of goods such as cartons or rags. Baled cargo is easily damaged by chafing. It should be carefully dunnaged and blocked off to prevent the cargo from moving. Flatboard dunnage is used underneath bales since dunnage with sharp edges would cut through the bale wrappings.

Protect baled cargo against damage from moisture. Use dunnage around all metal parts in the hold. Bales stowed in the wings of the hold are frequently placed on end so that only the outside layers of cargo will be damaged if moisture condenses on the sides of the ship or should chafing damage the bale.

Bales may be stained by oil left on decks or overheads or by leakage from cargo stowed on upper decks. To prevent this from happening, clean these areas before storing the cargo.

CARDBOARD CARTONS

When stowing cardboard cartons of cargo in the hold, they are stacked in brick fashion. Starting with the second layer of cartons, each carton must rest on two cartons below it. You must maintain a level floor, as the stowage proceeds outboard in the lower holds. Also care must be taken not to stow a carton in such a manner that it overhangs the tank tops. A row of cartons should not be stowed where the next carton, when placed in position, would rise above the

level of the rest of the tier. Use dunnage to level the top tier before the next tier is stowed. Use this procedure in the wings until the top of the stowed cargo is above the curvature of the hull.

Dunnaging between tiers of cardboard cartons is very important in distributing the weight properly, but it is not necessary to dunnage after each tier. In holds where cartons are to be stowed to a considerable height, lay a floor of dunnage after the third tier of cartons, followed by another floor of dunnage after three more tiers, a third floor of dunnage after five or six more tiers, and a fourth floor of dunnage after five or six more tiers. No more than four floors of dunnage should be necessary. The first two floors are most important.

If necessary, vertical dunnage may be used to prevent cartons from becoming lodged in the sweat battens.

Every effort should be made to keep tiers level. This can often be achieved by using smaller cases to fill up the spaces between large cases.

Put dunnage over lightly constructed cases before the next tier is started.

CASES

A case is a wooden or cardboard box that is used to package items. Strong wooden cases of cargo in uniform size are stowed, brick fashion without dunnage floors between tiers in the bottom of the lower holds.

Lightly constructed cases of uniform size are stowed in the same manner as cardboard cartons.

If the cargo consists of items of variable sizes, additional precautions must be taken. Stow heavier cases in the lower tiers. Never stow a case so that it rests directly on top of and inside four corners of the case beneath it unless dunnage is laid across the top of the lower case. This spreads the weight more evenly over the lower case.

CRATES

Crates are lightly constructed containers that are built as a framework with open sides and tops. They are used to ship items such as engines, or portable generators. Crates of this type are constructed for ocean shipping and are stiffened by the use of diagonal pieces of lumber. The bottoms are solid with well-built foundations that support their internal weight.

When crates are stowed, keep the tiers level by laying dunnage between tiers. Space the dunnage about 4 inches apart. Stow crates in the 'tween decks or in the top tiers of the lower holds.

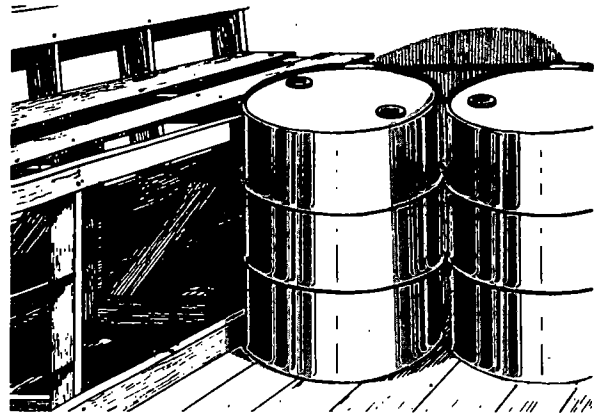
If it is necessary to stow cargo over crates, only light-weight cargo should be used.

DRUMS

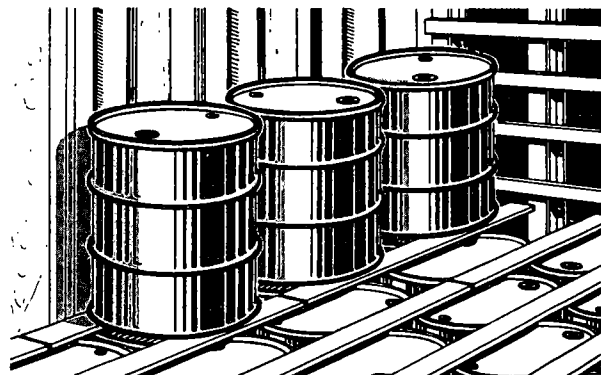
Fifty-five gallon drums normally are used to transport kerosene, diesel or gasoline and are stored upright with the bungs up. Here are some steps used in stowing drums.

- Lay dunnage approximately 6 inches apart on the deck and place drums on the dunnage.
- Build a shelf over the turn of the bilge or use cordwood for cribbing.
- Place dunnage between the first row of drums and the bulkhead. To stow the first tier, work from the wings to the center of the hold. Rest chimes squarely on the dunnage. If the first row does not fit securely across the bulkhead, spread the drums an equal distance and stagger the next row of drums (keeping the same spacing as in the first row.)

- To stow the second tier, lay dunnage over the first tier. Place drums on dunnage. Stow succeeding tiers in the same way.



SHELVING OVER BILGE



SECOND TIER DUNNAGE

LUMBER

Lumber may be shipped in bundles secured by bands, or it may be shipped loose. Careful planning reduces lost space in handling bundles of lumber. Fill large voids in with loose boards as necessary. Lumber may be stowed on deck or below deck. Loads of lumber on the weather deck must be securely lashed. The use of $\frac{3}{4}$ -inch chain made fast to pad eyes on deck and secured with turnbuckles, pear links, and slip hooks on top of the cargo is a suitable method of lashing. Space chain lashings no more than 10 feet apart.

When finished lumber is being loaded, manila rope slings are used for hoisting.

Never use hooks on finished lumber. If it is necessary to use pinch bars to stow lumber, place dunnage between the bars and the lumber.

When hoisting lumber, always use two slings. If only one is used, the boards on the inside of the load may slip out, damaging cargo and injuring personnel.

Lumber may be unitized for easier handling by making up drafts of uniform size and banding the cargo so that each draft can be handled as a unit.

STEEL PLATES

Steel plates and sheets of steel should be stowed on the bottom in the lower hold or the 'tween deck. They should be stowed level on dunnage so that the weight of cargo loaded on top of it will be evenly distributed over the entire plate. Stow steel plates in a fore-and-aft direction if possible.

The handling of a steel plate is a difficult and dangerous operation. The following safety precautions should be strictly enforced when this type of cargo is being handled.

- Only use plate-handling clamps to lift steel plates high enough to land the plates on dunnage where they can be properly slung with wire rope slings. Never use plate-handling clamps for hoisting steel plates into or out of a hold.
- Sling steel plates on the quarters; i.e., at a point about one-quarter of the length of the plates from each end.

HEAVY LIFTS

Heavy lifts may be any single package, pallet unitized, or containerized cargo (except sea vans or milvans) that weighs 1,000 lb or more. Cargo handlers must be extremely cautious of weight when handling this cargo. This is because the boom lifting capacity of most cargo ships is 10,000 lb, or 5 tons. Heavy lifts such as track vehicles and large heavy cases that are common in every day terminal operations are discussed in this section. There are other types of heavy lift not specifically discussed, but the procedures discussed

- If long lengths of plates have a tendency to bend when slung, use a round turn on each sling and use taglines to control the draft.
- Use crowbars or pinchbars for moving the plates into the final stowed position.

PILES

Piles are long concrete or wood piles or logs. They are sometimes called pilings. Piles are usually stowed on deck, but it may sometimes be necessary to stow them below deck. Piles stowed below deck are usually placed in the larger hatches. The following precautions are to be taken when handling piles.

- Always use two slings when hoisting piles. Each sling should have a safe working capacity capable of supporting the load by itself.
- Always use taglines when handling piles.
- The creosote on wood piles will burn the skin and eyes. After handling these piles, do not touch your face or eyes with your hands until you have thoroughly washed your hands, gloves and anything else that has touched the creosote.

Piles over 60 feet long are usually stowed on deck. It may sometimes be necessary to change the position of the slings in order to place the piles in the stowed position. Use a dragline (discussed later) for pulling the piles into position. If necessary, use the gear at the next hatch to stow extremely long piling.

in this section would apply.

Before heavy lifts are loaded, prepare the holds to receive the cargo. Assemble dunnage material for securing the lifts, blocks, shackles, draglines, bars, and other necessary equipment beforehand. Load it into the hold before the first lift is hoisted aboard.

Before a heavy lift is picked up, check all gear as described in chapter 4.

Use tag-lines on all heavy lifts. All personnel must stand well clear of a heavy lift coming into the hatch until it is lowered to within a few inches of the deck. Personnel can then assist in steadying the lift for landing.

TRACKED VEHICLES

Tanks, crawlers, cranes, and bulldozers are moved from the square of the hatch to their stowage position by draglines. The tracks are braked or released to control the movement and direction of the vehicle. Only experienced operators of heavy equipment are permitted to steer tracked vehicles. The following procedures apply to tracked vehicles.

- Tracked vehicles should be stowed in a fore-and-aft position whenever possible.
- Multi-fuel vehicles will be left in neutral gear with the brake engaged.
- Gasoline driven vehicles will be left in gear with the brakes on.
- Turrets on tanks, and cabs on cranes, are locked or lashed in position.

A solid floor of planking not less than 2 inches thick must be constructed and nailed down before tanks, bulldozers or cranes are loaded on top of cargo such as steel plates or slabs of metal. When tanks are stowed in the 'tween deck, similar flooring is laid. Secure tracked vehicles weighing less than 18 tons with at least 4- by 6-inch lumber. Secure those weighing more than 18 tons, whether stowed on deck or below deck, with wire rope or chain.

WHEELED VEHICLES

Wheeled vehicles are hoisted aboard ship with vehicle bridles and slings. They are landed in the hold so that they are headed in the direction of stowage. After they are landed, one man releases the brake and steers the vehicle while it is pushed into stowage position. If the vehicle cannot be pushed into position by hand, a dragline (which is discussed later) is set up. In large hatches, a dock tractor is used instead of the dragline. If it is necessary to move one end of the vehicle side-

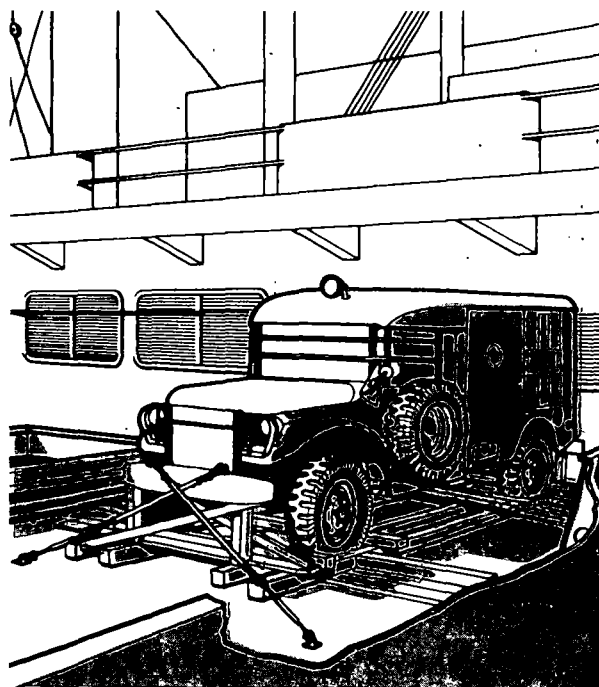
ways to stow it in the desired spot, this is accomplished by either of the following methods.

- Dunnage that has been smeared with skid compound or grease is placed under the wheels on the end of the vehicle to be moved. Dunnage is laid in the direction of the move. A dragline is set up and the ends of the vehicle are dragged to the desired stowage spot.
- If heavy-duty rolling jacks are available, they are used to move the end over.

Stow vehicles fore and aft whenever possible. As in the case of tracked vehicles, stowing them fore and aft lessens the chance that they will break loose when the ship rolls in heavy areas. When it is necessary to stow them athwartship, obtain permission from the vessel's master or his representative. Take special precautions when securing vehicles stowed athwartship.

The best method for securing any vehicle depends on the type of vehicle and its stowage location.

Use the following illustration and procedure as a guide in securing vehicles.



- Set the brakes of the vehicle.
- Block the vehicle at both sides and at both ends so that it cannot move in any direction. The size and type of vehicle will dictate the size of timber to use.
- Brace individual vehicles to bulkheads, stanchions, or other vehicle blocking.
- Lashing is required in addition to blocking and bracing. Vehicles must be lashed with wire rope. Block under bumpers or chassis to keep tension off the springs.

LARGE HEAVY CASES

Large pieces of cargo such as walk-in refrigerators or decontamination units are often shipped in large cases. The main problem in stowing large heavy cases is moving them from the square of the hatch to the place of stowage. This can be accomplished by several methods.

When possible, land the case onto rollers. Make sure it is landed so that it is heading in the direction of stowage. Remove the sling on the side next to the coaming. By topping, lowering or swinging the booms, move the head of the boom in the direction of the stowage. At the same time, put a strain on the sling still attached to the case. The case will move in the desired direction until the sling or cargo block is stopped by the coaming. Rollers are normally removed before the case is placed in the final stowage location. If further movement is necessary, use a dragline as described below.

Well-constructed cases weighing up to 7 or 8 tons can be landed on rollers and moved into position with crowbars and pinchbars.

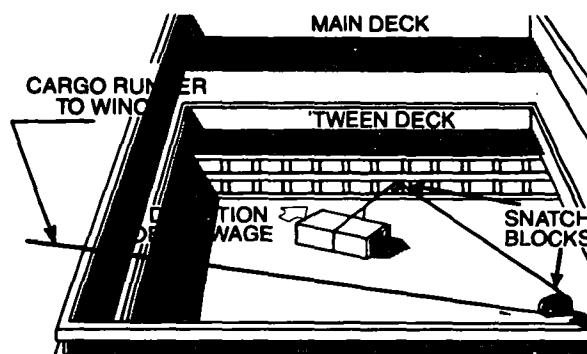
When rollers are not available, land the cases on dunnage runways on which skid compound, soap, or grease has been smeared. The cases are then sneaked into position with the dragline.

DRAGLINES

Draglines are set up in the holds and 'tween decks to drag heavy lifts from the square of the hatch to the place of stowage or from the place of stowage to the square of the hatch. These are

long lengths of wire rope (approximately 60 feet) with an eye in each end. The dragline is rigged in the following manner.

- Attach a snatch block to the side of the cargo compartment or to the bulkhead at each end of the desired stowage location and in line with it.
- Attach a second snatch block to stanchion or other fitting to provide a fairlead to the square of the hatch.
- Attach one end of the dragline to the item to be stowed. Pass the line through the snatch block that is made fast in the direction of stowage and then pass it through the fairlead block at the square of the hatch, attaching it to the other end of the cargo fall, as shown here.



- Drag the lift to its stowage position by taking up on the cargo runner with the winch. It is often necessary to drag one end of a lift to the place of stowage and then shift the snatch block to another position to drag the other end. Therefore, an additional snatch block is hung in the second position before starting the dragline operation.

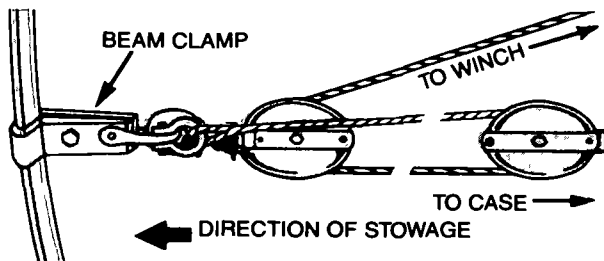
Many vessels have special runners that are used for dragline operations, and it is often necessary to use them, and to take them off the boom. When cargo runners are used, the following precautions should be taken.

- Always strip the cargo runner from the boom and lead it from the winch to the heel-block and then to the hold.

- Always use a fairlead snatch block at the top of the hatch inside the coaming.
- Never run the cargo runner under the coaming. The runner will fray when pulled over the metal edges.

Whenever dragline operations are in progress, the following precautions should be taken.

- Use additional snatch blocks as fairleads to prevent chafing.
- When loading heavy lifts with the jumbo boom, do not provide power to dragline with cargo hook unless there is no other means available.
- If the lift is too heavy for the winch to pull, improvise a tackle using additional snatch blocks.
- Fasten beam clamps to stiffeners or frames for securing snatch blocks when no pad eyes are available.



- Never pull on the side of a pad eye. This will cause the pad eye to bend over on its side.
- Keep men out of the bight of the lines at all times.

To prevent damage to cargo and injury to personnel, the following rules are to be enforced.

- When slings are placed around heavy cases for dragging, place dunnage between the case and the bearing part of the sling to prevent damage to the case.
- The case must be closely observed while it is being dragged into position to insure that it does not become jammed against dunnage, deck fittings, or other cargo. Any attempt to drag the lift while it is jammed will place an additional strain on the gear, and it may carry away the sling or pull it through the side of the case.
- Keep all personnel out of the area between the lift being dragged and the place of stowage. "Human hamburger" could be the result of violating this common sense rule. Because of its size and weight, heavy lift cargo presents more hazards to the terminal operations coordinator than any other type of general cargo.

REFRIGERATED CARGO

Stowage of refrigerated cargo does not differ greatly from that of general cargo, except that refrigerated cargo requires more care with temperature and ventilation, and it is not normally palletized. Foods having a strong odor should not be mixed with those having a tendency to absorb odors. After all, apples that taste like onions don't sell very well. All cargo compartments must be at the prescribed temperature before loading to prevent refrigerated cargo from thawing or spoiling.

LOADING

Of all the types of cargo loaded, refrigerated cargo is the most difficult to handle because of

the high degree of spoilage resulting from rough handling, inclement weather, and delays in loading.

Speed is essential in loading refrigerated cargo. Careful planning is necessary so that commodities will not remain out of refrigeration too long.

Damage to the cargo resulting from exposure to rain, handling that has caused bruising, or delays in loading that have caused temporary thawing may not be immediately apparent to the loading authorities. However, any damage will become apparent at the destination and could result in the forced issue or destruction of the entire cargo.

The selection of the cargo handling gear is important because most of the containers are of light construction to allow circulation of air. Because of this, they can be easily crushed.

One way to prevent damage to cargo already stowed is to use hatch tents in inclement weather. Using hatch tents in the tropics during daytime operation will keep the temperatures of cargo compartments from rising too rapidly. It will also reduce the number of delays required to close the hatch.

Representatives of the port veterinarian are present at all times during loading to inspect the condition of the cargo and the correctness of the stowage. They also monitor the temperatures of the loaded cargo, the unloaded cargo and the refrigerated holds.

As terminal operations coordinators, you should maintain a record of temperature changes dur-

ing cargo operations. These records will help the loading personnel meet their responsibility for keeping the hold at the right temperature.

The cargo officer must inform the master of the vessel of what temperatures must be maintained throughout the voyage to insure the delivery of the cargo at destination without damage.

INSPECTION

After the hatch has been loaded, an inspection of the stowage is made by a ship's officer, a cargo loading officer, and a representative of the port veterinarian. The inspectors determine whether ample allowance has been made for the circulation of air and whether the cargo has been properly stowed. If all the above precautions are followed, the troops in the field will not miss their steak dinner because of spoilage.

PALLETIZED CARGO

Palletized cargo consists of one or more packaged items placed on a pallet and banded together. Palletized unit loads are normally formed on general purpose four-way entry pallets.

A palletized unit load may not be more than 52 inches long, 43 inches wide, and 54 inches high (including the pallet). The gross weight of the cargo may not exceed 3,000 pounds. Constructed to maximum size, the cargo may hang over the pallet 2 inches on each end and 1½ inches on each side. The palletized unit load will occupy approximately 70 cubic feet of shipping space.

The cargo and pallet are securely bound together with various types of banding. A common method is to use four steel straps around both cargo and pallet. Two of the straps are spaced equally lengthwise around the pallet. The other three straps are spaced equally crosswise around the pallet.

When a small number of palletized loads are stowed, the best location is the square of the hatch. However, if the volume of palletized cargo is great, it must be stowed in the ends and wings.

Unlike heavy lifts, pallets are not designed for dragging. Although pallets can be dragged into the wings and ends, dragging is time-consuming and dangerous. It can cause excessive damage to the cargo.

The following methods are recommended for placing palletized cargo in underdeck stowage when there is sufficient headroom for forklifts to maneuver.

- Place the required dunnage in the hatch. Usually, little dunnage will be necessary since the pallet itself serves as dunnage, but some dunnage may be needed for leveling off, padding obstructions, etc.
- Hoist a forklift into the hatch. Shortmast, pneumatic-tired forklifts should be used. Land the pallets in the hatch so that the access slots face in a direction requiring a minimum of forklift maneuvering. Using the forklift, engage the load and proceed to the place of final stowage.

If pallets cannot be tiered underdeck because of insufficient headroom clearance, it is often

possible to load one pallet on top of the other in the square of the hatch and move both pallets into the final stowage position with the forklift.

Use filler cargo or chocking to take out the sheer at the bottom of the hatch and to fill in any voids created by the shape of the cargo or stanchions or other fittings. Use a type of filler cargo

that will not be easily damaged.

If it becomes necessary to operate a forklift on top of unitized cargo, you must first dunnage the entire hatch with two layers of lumber, one layered fore and aft, and one athwartship, to eliminate damage to the cargo. Palletized cargo is normally not stowed on deck.

DECK CARGO

The weather deck is used to stow cargo that is too large to go through the hatches, or when there is no room below deck for storage. Whatever the reason, deck cargo is loaded last and discharged first. This prevents cargo from being lifted high to pass cargo over the deck cargo, and to give the handling personnel a clear view of the operations area.

Cargo loaded on deck should be protected as much as possible from damage by sea water. Strips of dunnage are laid on deck to receive cargo, to allow removal of slings, and to protect cargo from water on deck.

When a large quantity of cargo is to be stowed on deck, care must be taken to avoid blocking off equipment listed below. It is good practice to outline in chalk the spaces to be kept clear, such as:

- Bitts and chocks.
- Sounding pipes to the bilges and the ballast tanks.
- Handles of valves controlling the operation of watertight bulk heads or piping systems.
- Any other items of equipment essential to the safe operation of a vessel.

CATWALKS

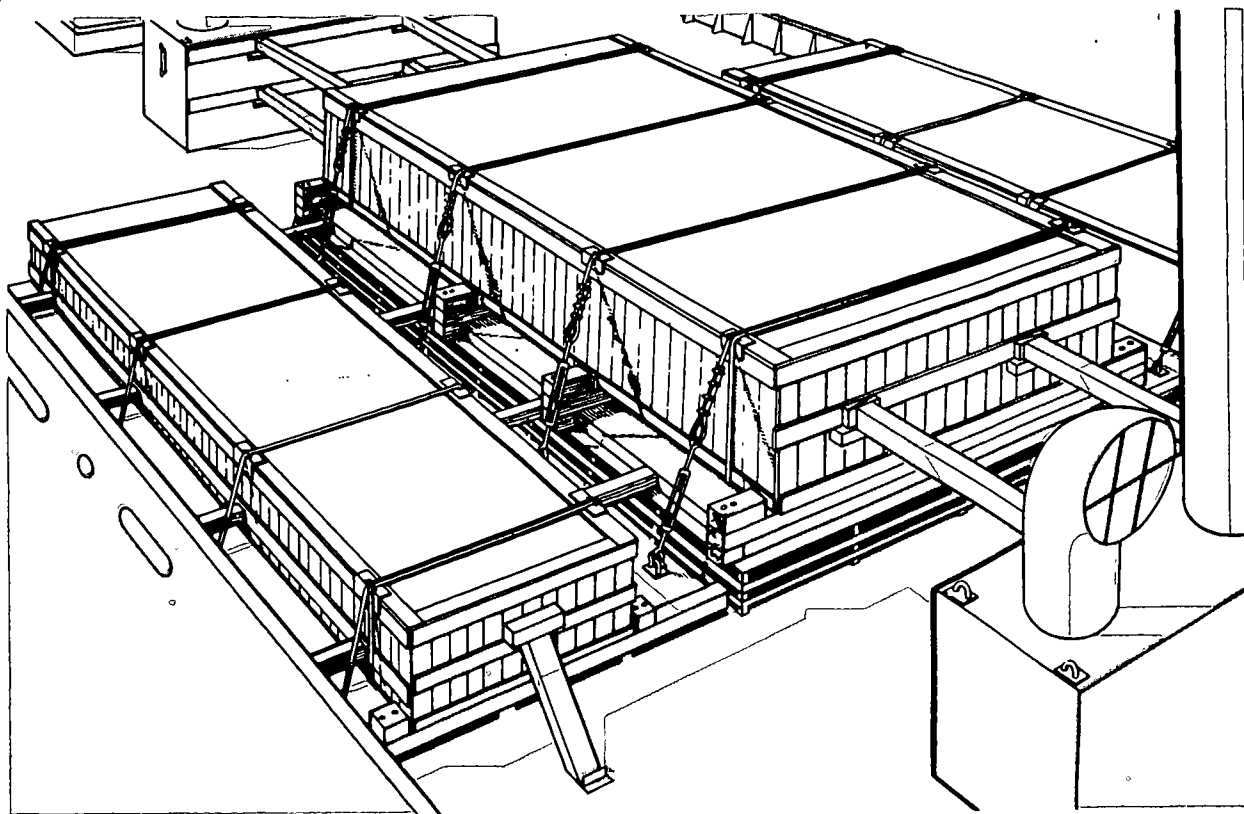
For the safety of the crew, catwalks are constructed over deck cargo. They are to be less than 3 feet wide and should have strong handrails and suitable approaches. Avoid straight ladders to the well deck. Ladders should be at an angle. Ramps are built so that the crew will have ready access to lifeboats, gun stations, and frequented work areas.



CASES

Deck cargo is stowed so that it can be lashed in three separate blocks: one on the square of the hatch and one on each side. Observe the following precautions when cargo is stowed on deck.

- Use wire rope and chain lashings.
- Use angle irons on corners or edges under lashings to prevent cutting into the case.
- Sheath exposed forward parts of the cases for protection against sea water.
- When necessary, stow deck cargo on the square of the hatch in such a manner that the cargo extends beyond the hatch coaming.
- Tables must be built to support the overhanging cargo beyond the square of the hatch.



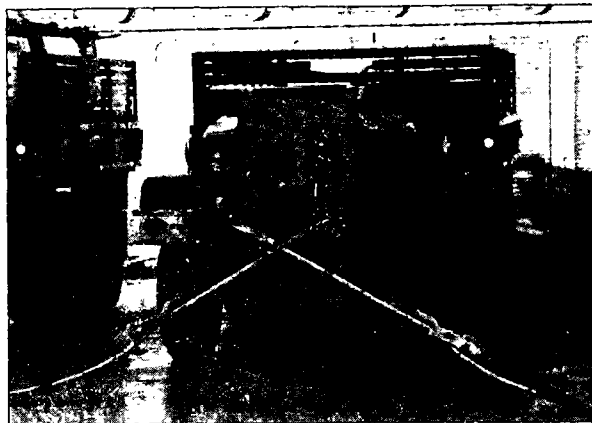
- When cases are secured on deck, bracing is preferred to shoring since shoring has a lifting effect on cargo.
- Use lag screws or bolts to tie timbers together. Use nails and spikes only on small timbers or where it is impossible to use screws and bolts.

Block up the chassis to take pressure (caused by the tension of the lashing) off the springs.

The following shows the deckloading of vehicles when mechanical quick-release devices are available as part of a ship's gear. When these devices are used, no special blocking and bracing or dunnage as detailed above is necessary.

WHEELED VEHICLES

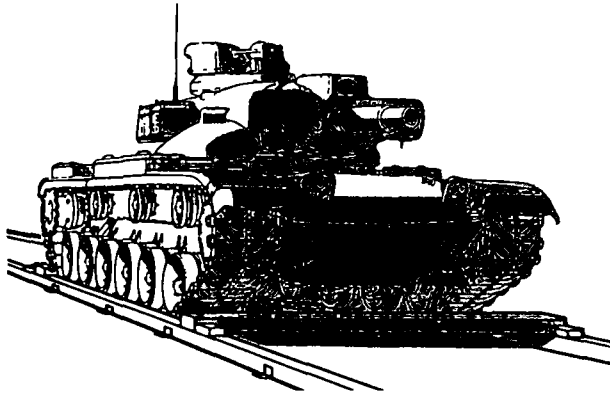
Normally, vehicle engines should be facing forward. Place a double layer of 1-inch-thick dunnage on deck under the wheels. Block each vehicle on both sides and at both ends so that it cannot move in either direction. Care must be taken to brace all wheel chocks. A minimum of two lashings are required on the front and two on the rear of vehicles such as trucks and ambulances. However, additional lashing may be required by the master of the vessel. Lashing may be either crossed with the cable forming an "X" or led outboard from the vehicles.



TRACKED VEHICLES

Tanks and other tracked vehicles when stored on deck are secured as follows:

- Land the vehicle treads on two 4- by 12-inch timbers.
- Secure an 8- by 12-inch timber against the treads on each side by three angle irons. Each angle iron should have holes for two $\frac{7}{8}$ -inch lag screws to be used to secure the 8- by 12-inch timbers to the deck.



- Chock each end of the vehicle with a timber placed against the treads and secured to the fore-and-aft timbers.
- Lash vehicles to the satisfaction of the vessel master. Tie rods, chain, or wire rope and turnbuckles are used for this purpose.

The timber sizes given above are merely guides. The proper materials are not always available in oversea areas.

SMALL BOATS

Watercraft present a special transportation problem because of their size, weight, and comparative fragility. Most watercraft are so large that they must be stowed on deck. Cradles especially made for the particular type of watercraft may be constructed by the manufacturer. However, in most cases, the loading activity has to make them from available materials. Since the craft sit high in the air, they are exposed to wind and sea more than most cargo. Lashing must, therefore, be applied with special care.

DISCHARGING CARGO

In the previous sections you have learned how to load, stow, and secure cargo aboard the vessel. In this section, you will see how to discharge cargo from the ship. In any type of cargo operation, there is a right and wrong way of doing

things. During the past years, tests and experience have helped us devise safe and speedy methods for unloading deck cargo, for breaking out cargo in the hold, for clearing the terminal, and for setting up temporary holding areas.

DECK CARGO

Unload deck cargo first. Even deck cargo that will not interfere with the discharge of the hatch is removed first to provide more room to work on deck, unless it is destined for another port of call.

Remove all lashing material from the ship unless you are otherwise instructed. This material is processed as follows so that it may be found again later with minimum difficulty.

- Remove wire rope clips and replace nuts. Assemble, then sort by size, and place in bins or boxes plainly marked with the sizes of the clips.
- Coil and tie off wire rope. Tag it to show the size of the rope. If the wire is to be stored for a long time, it may be lubricated and boxed. Place wire of the same diameter and approximately the same length on reels if the amount of lashing received warrants such action.
- Open turnbuckles, sort by size, lubricate, and place them in bins or boxes marked with the size of the turnbuckles.
- Remove shackles and replace pins. Sort the shackles by size and place them in boxes or bins marked with the size of the shackles.

- Remove blocking material from the ships. Clean and sort it so that it will be available when needed.

- Discharge dunnage material as described in the previous section of this chapter on securing cargo.

CARGO FROM HOLDS

Keep cargo in a hold as level as possible during discharge. Breaking out cargo stacked higher than your reach or tunneling under other cargo is very dangerous.

It is a common practice to load general cargo, drummed cargo, and barreled cargo in the wings and ends of the hatch. Vehicles and heavy lifts are loaded in the square. When discharging cargo loaded in this manner, build tables or platforms up in the square of the hatch near the coaming so that the cargo can be handled without damage

to cargo or injury to personnel. These tables are constructed of lumber or of pallet boards. When pallet boards are used, dunnage is laid on top of the pallets to make a solid floor for the men working on the table. For light cargo, tables are necessary only until enough cargo has been removed to enable men to stand on the cargo and pass it down. For heavy cargo, such as asphalt in barrels or POL in drums, tables should be used until the cargo can be handled from the deck without having to reach for it. As cargo is discharged from the vessel it is moved away from the pier.

CLEARING A TERMINAL

One of the most important phases of your job is terminal clearance. Cargo that is allowed to accumulate on the pier hinders discharge and eventually brings the operation to a standstill. Accumulated cargo is subject to damage and pilferage.

You must clear cargo from the terminal as quickly as possible. This is done by loading the cargo directly on to trucks and trailers or railway

equipment for delivery. This is a fast and efficient method of terminal and pier clearance because the cargo is handled only once.

If quantities of cargo belonging to several services are being unloaded, clearance carriers are lined up on the pier according to service. Drafts of cargo are then transported to them from the hold using forklifts.

TEMPORARY HOLDING AREAS

A temporary holding area is a warehouse or secured area used to store cargo on a temporary basis.

Temporary holding areas are required when the rate of discharge exceeds the capability of clearance transportation. Use covered areas whenever possible or available. This is especially important if the cargo is subject to weather damage or is expected to remain in the terminal area for extended periods of time.

After considering the consignees of goods and the facilities available, the commander of the discharging terminal generally establishes holding areas so that goods are segregated by destination and commodity. Segregation by destination is usually the most appropriate method, although incompatible items such as ammunition and fuel are still segregated on a commodity basis for safety reasons.

PREVENTING DAMAGE TO AND LOSS OF CARGO

As part of the Department of Defense Transportation System, you have the responsibility to prevent or protect the cargo from damage. This section points out what must be done for cargo

when damage occurs in transit; in handling; or from chafing, crushing, contamination, moisture, or shifting.

DAMAGE IN TRANSIT

Frequently, cargo is damaged in transit before it is received at the piers. Inspect the cargo carefully while it is being received. If you have any doubt about a package being damaged internally, annotate documents accordingly, have the package placed to one side if possible, and advise your supervisor. This will be covered in more detail in chapter 9.

If during loading operations you find packages with insufficient packing, or that show signs of

wear and tear or of attempted pilferage, return them to the warehouse for disposition. The condition of such cargo almost always worsens during the voyage. It not only arrives at the destination damaged, but it may have damaged adjacent cargo.

Never recover security cargo until the security officer has made an investigation and has given permission.

DAMAGE IN HANDLING

Damage in handling is caused chiefly by exposure to inclement weather conditions, carelessness, and the use of improper gear.

To protect cargo from weather, cover hatch openings with hatch tents. The tents will also provide protection for the men working in the hatch. Tarpaulins used to cover the remaining cargo in the square of the hatch does much to reduce damage. However, it is useless to protect the hatch and the cargo if the cargo is allowed to remain in the open on the pier after being discharged from the vessel.

Unsuitable or badly adjusted slings may dislocate or break packages and damage their contents. The following precautions should be taken when using slings.

- Avoid crushing light or fragile articles in net slings, and avoid banging drafts of cargo against the hatch coaming. Few commodities can be handled in net slings without being crushed.

- Avoid building drafts too high. Even though the fragile boxes are placed on top, they may fall when the sling is removed on the pier or in the hold.
- Insure that slings are securely fastened around the load. Slings placed haphazardly may slip and part, thus allowing the entire draft to fall to the deck, to the pier, or into the water.
- Avoid careless winch operations, especially when handling fragile cargo. Careless handling of a load may damage the cargo in the sling, the sling itself, or the cargo already stowed.
- Care must be exercised when using hooks, crowbars, and similar tools. The shipper's marks on boxes, **THIS SIDE UP**, **FRAGILE**, etc., must be observed.

DAMAGE FROM CHAFING

Chafing is the wear of cargo caused by friction from rubbing against other objects or items.

Chafing usually results from improper chocking, blocking, and bracing of cargo in a vessel, a

railroad car, or a barge. On a vessel, cargo damage results if the motion of the vessel causes the pieces of cargo to rub against each other or against projections in the hold. Chafing damage is caused by dragging cargo over rough spots or over other

cargo. Chafing is dangerous with flammable cargo in metal containers, particularly if heat is produced through friction. If cargo is properly chocked, blocked, and braced, chafing is not likely to occur.

DAMAGE FROM CRUSHING

Crushed cases and containers usually are the result of carelessness in slinging, improper dunnaging, or pressure brought about by stowing heavy cargo on top of fragile cargo.

Proper stowage, shoring, and chocking helps reduce damage to cargo from crushing.

Continuing studies of packaging have resulted in the reinforcement and general improvement of packages. Most damage is attributed to handling and stowing rather than to the construction of the containers.

DAMAGE FROM CONTAMINATION

In planning the loading of a ship, careful consideration is given to segregating cargo to avoid damage from contamination. Many foodstuffs are contaminated by being put too close to paint,

rubber, etc. Since odors left in the hold of a vessel can contaminate future cargo, the hold must be clean and free from odors before loading.

DAMAGE CAUSED BY MOISTURE

Damage caused by moisture is called sweat damage. Condensed moisture may corrode metal, mildew textiles, etc. This type of damage ruins more cargo than any other type. The methods used to reduce or eliminate sweat damage include:

- Proper preparation of cargo for shipment.
- Proper use of dunnage to provide drainage and air circulation.

- Use of mechanical ventilation or dehumidifying systems.

A frequent cause of wet cargo is an improperly closed hatch that allows sea water to enter the hold. At times it may be necessary to discharge wet cargo. In this case, make special provisions for drainage and drying.

DAMAGE FROM SHIFTING

There is always danger that cargo may shift if empty spaces are not adequately shored off. Violent rolling or pitching can cause a few pieces of cargo to break out of stowage and move about freely in the hold. These pieces, in turn, dislocate other cargo against which they are thrown. Serious damage to the cargo and the ship can result. Take the following precautions to avoid damage from shifting.

- Make sure while the cargo is being loaded that there are no empty spaces left into which cargo may shift during shipment.
- Thoroughly secure and shore all cargo so that it cannot move.
- If cargo is likely to settle, make provisions to secure it after it has settled.

CARGO SECURITY

To minimize pilferage, each military terminal and transfer facility must have a comprehensively developed and continuously improving **CARGO SECURITY PROGRAM**. To be effective, the program should include the following:

- A complete study of all aspects of the cargo transfer and intransit storage operation in order to identify security weaknesses.
- Complete instructions in cargo security for all personnel.
- Implementation of physical security policies.
- Assignment or employment of cargo security.
- Utilization of theft prevention and detection equipment.

It is unlikely that cargo pilferage will ever be completely eliminated. However, private industry, US Army Military Traffic Management Command (MTMC) operated terminals, and other Government agencies concerned with cargo security have developed techniques that are effective in reducing cargo loss caused by pilferage. Some of the **PREVENTIVE MEASURES** that may be used in oversea military terminals are listed below.

SECURITY PERSONNEL

- Request security assistance from military police.
- Appoint a terminal security officer.
- Establish port pilferage prevention and detection teams to monitor the receipt, documentation, handling, storage, and disposition of cargo passing through the terminal.
- Assign guards to all terminal exits.
- Give security personnel advance notice of cargo entering the terminal that will require surveillance and protection.
- Post a security guard or cargo checker at

open warehouses and ship's hatches during lunch and break periods.

- Restrict privately owned vehicles from entering cargo handling or intransit storage areas.

FENCES AND GATES

- Fence the perimeter of the entire terminal with chain link fence topped by three strands of barbed wire.
- Inspect the fence daily to insure that there are no openings in it or under it that would permit objects or persons to pass through.
- Maintain separate gates for personnel and vehicle traffic.
- Provide manned gatehouses at all vehicle entrances and exits.
- Clear the area around the gatehouse of any objects that may restrict the guard's field of vision.

HIGH VALUE AND SECURITY CARGO

- Provide a secure cage, crib, or vault in the shipping and receiving area for control of sensitive or high-risk cargo.
- Assign responsibility for receiving, accounting for, and releasing sensitive or high-value cargo to a specific individual.
- Maintain a record of each shipment entering or leaving the security area. The record should include date, time, description of cargo, seal number, identification number of the truck or other equipment making pickup, and name and rank and organization of the equipment operator.

VEHICLES

- Establish a truck control system using gate passes.
- Record date and hour of release on trans-

portation control and movement document (TCMD), gate pass, or other control documents so that gate security personnel can detect abnormal time lags in travel from the loading area to the gate.

- Designate a responsible person to inspect the interior of each truck after unloading.
- Do not spot trucks at warehouses until cargo handling personnel are available.
- Compare the TCMD or other document with loaded cargo while spot checking trucks.
- Establish designated parked areas for privately owned vehicles.

LOCKS AND KEYS

- Establish and maintain strict control and accountability procedures for all keys to security areas, containers, and other locked cargo areas.
- Issue master keys only to those who need them and on a need-to-have basis.
- Number all keys and obtain signatures of the recipients when issued.

- Recover all keys issued from persons being transferred or terminated.
- Periodically change padlocks on security lockers; change immediately if a key is reported missing.

MISCELLANEOUS

- Always have a cargo checker during cargo transfer operation.
- Close and lock warehouse doors during lunch and break periods.
- In addition to signing each TCMD, government bill of lading (GBL) or other cargo document, require cargo checkers to legibly print their name or use self-inking identification stamps on these documents to eliminate the problem of illegible signatures.
- Keep doors of rail cars containing cargo closed, except when loading or unloading.
- When possible, secure MILVANS and commercial containers by butting their door ends against each other.

SUMMARY

All the measures listed here may not stop all damage and loss of cargo, but it can help. Remember also that these measures are not the only ones that you can take. You may see several ways in which cargo is damaged or lost, and new or different ways of reducing it. It is part of your job to let your supervisor know about your observations and suggestions. The best idea in the world is no better than the worst as long as it is still locked up in the mind of the person who first thought of it.

So, there really is a lot more to loading and discharging cargo than attaching powerful gear to it and slinging it over the side. With modern cargo handling operations and equipment, cargo handling is no longer a field for "strong backs and weak minds." As a terminal operations coordinator, you have a very responsible job. The overall safety of the cargo and the ship depends on you.



11

12



13

14

15



CHAPTER 6 LOADING HAZARDOUS CARGO

Rockets, sparkles, loud explosions, and bombs bursting in air is a great way to celebrate on the Fourth of July. When the same things begin to happen aboard a ship carrying munitions, it is not a celebration. It's a catastrophe.

Explosive cargo, chemical agents and munitions are not only dangerous, they can be downright fatal if mishandled.

In this chapter we are going to talk about how to safely stow hazardous cargo. This includes getting it aboard, placing it, and securing it. The importance of careful handling and stowage of hazardous cargo is obvious. Let's save explosions for the Fourth of July and the battlefield. To learn more about the subjects covered in this chapter, refer to TM 55-607; Navy NAVSEA OP 3221, redated September 1976; Coast Guard regulations for military explosives and hazardous munitions; Code of Federal Regulations (CFR), title 46, part 146.

BASIC LOADING AND SECURING REQUIREMENTS

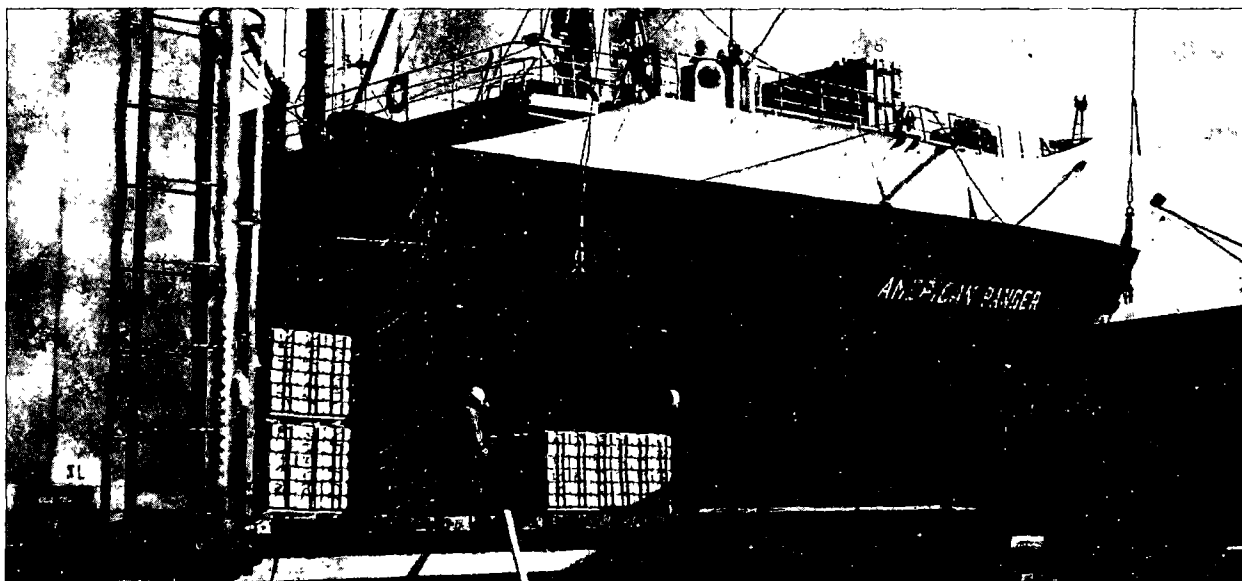
GENERAL LOADING PROCEDURES

The loading of military explosives is performed in two phases:

- Transfer of the cargo from railcars or trucks to the dock.
- Transfer from dock to ship.

Railcars or trucks are subjected to visual inspections en route to the loading area. This is to

make sure that the cargo has not been damaged in transit. After the railcar or truck has been opened and its contents inspected, cargo is transferred by forklift truck to designated spotting points for each hatch. When handling, loading, or unloading military explosives, use equipment made especially for this type of cargo.



Explosives positioned for hoisting are given a final visual inspection to detect defects in strapping or packaging. All metal strapping should be tight. The items that make up the unit load should be undamaged. Broken or loose banding of explosives on pallets requires that the defective pallet of explosives be removed, separated from the others, and corrected prior to loading. Defects in banding must be reported immediately to the supervising authority for evaluation of the banding and possible on-site rebanding. If damage is evident, transfer the load immediately to an area away from normal loading activity to wait for further instructions.

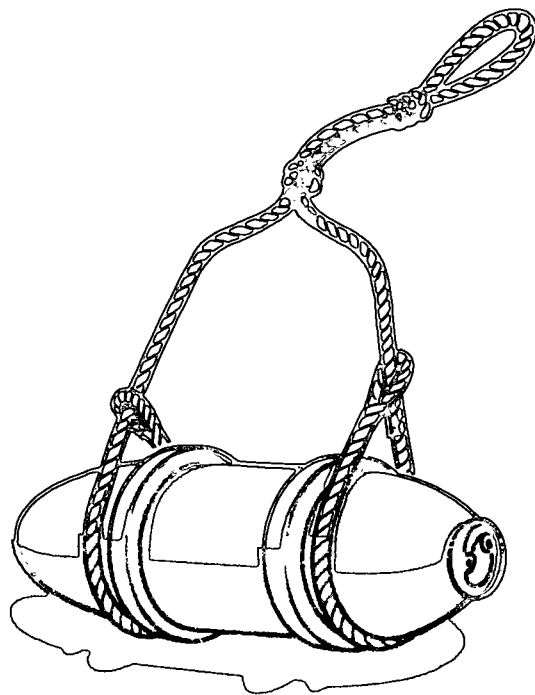
If any of the following conditions exist, do not load the explosive item for transportation or stowage on board any vessel:

- Container failure or evidence of leaking of liquid components.
- Unusual appearance of the container, such as dampness, mold, or stains, indicating internal defects in the absorbent material.
- Defective ammunition and/or packaging.

Explosive cargo with any of the above problems must be immediately removed from the loading area, isolated, and processed in accordance with safety regulations.

At the spotting location, riggers/hooks place the appropriate sling on the load and check pallet balance and construction for lift capability.

To eliminate excessive drift, use slings that are as short as possible when handling military ammunition or other explosives. A cargo safety hook is used almost all the time for hoisting loads of military explosives aboard merchant-type ships. Bomb slings made of manila or wire rope are used to hoist single bombs aboard the vessel. When the sling is attached to the load and secured to the hook, the signalman signals the



BOMB SLING

winchman to hoist the load. Do not exceed the weight limits when hoisting drafts. Lift drafts in a single, smooth motion, clearing the rail and hatch coaming by at least 3 feet. If the activity within the hold restricts the lowering of the load, the load must be returned to the dock or lowered within 6 inches of the ship's deck until loading begins again.

The load is moved from the square of the hatch to the stowage position by forklift truck. Final positioning for a tight stow can be accomplished by pinch-bar adjustments. Pallet trucks or transporters are often used to stow loads in areas of difficult access. All loads must be stowed right side up on their pallets or skids.

As the loading of each compartment is completed, the stowage is certified by the ship's master or his authorized representative. A cargo stowage inspection record is used for this purpose.

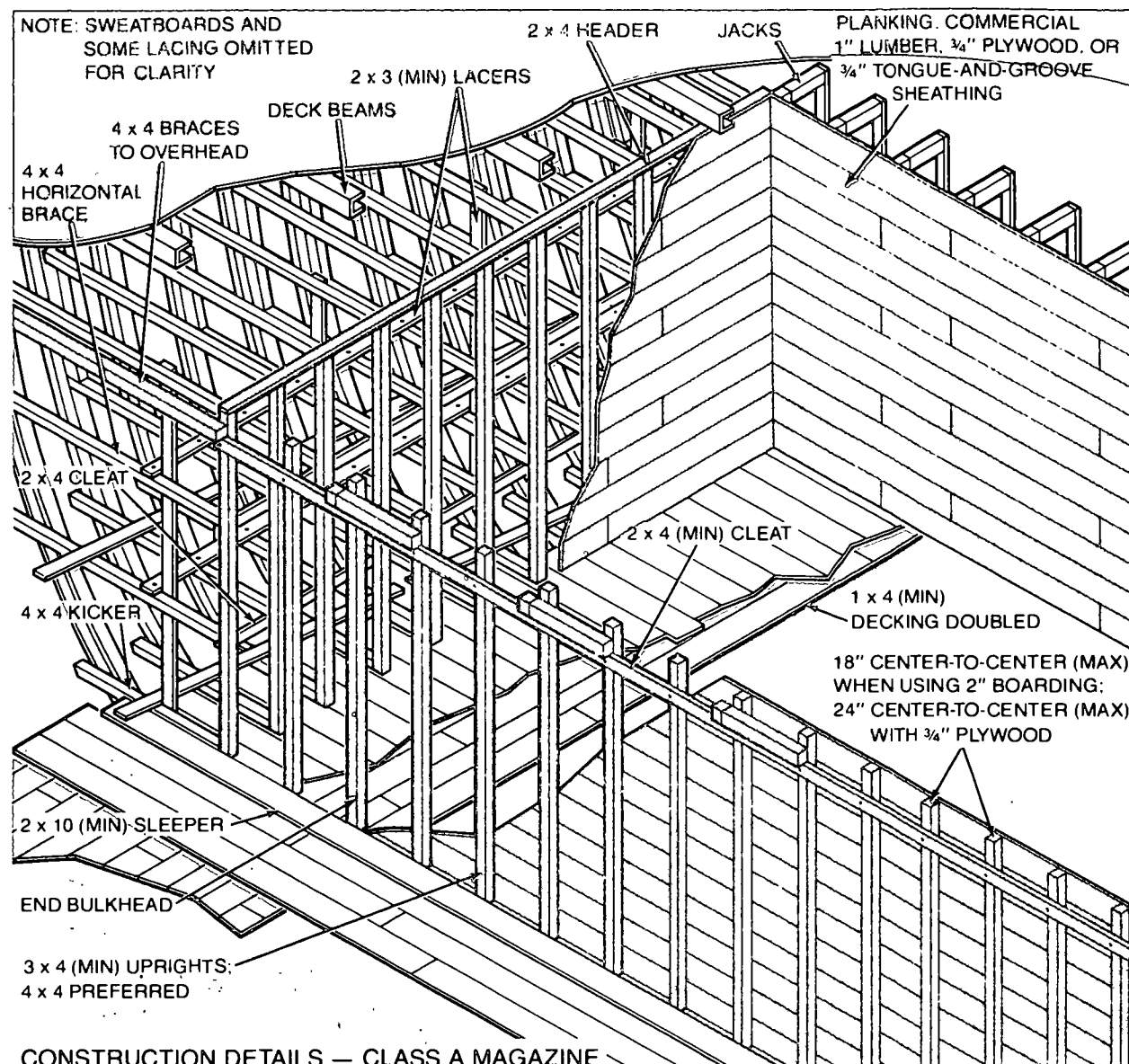
TYPES OF STOWAGE

The types of stowage specified for military explosives are termed as follows.

MAGAZINE STOWAGE — CLASS A

When stowing, isolate magazines because they are highly sensitive to shock, and they will ignite very easily by a spark or friction. Any class of

ammunition requiring magazine stowage A is not to be overstowed with any other kind of cargo. The type of explosives stowed in magazines must be compatible.



CONSTRUCTION DETAILS — CLASS A MAGAZINE

AMMUNITION STOWAGE

Military explosives should be stowed in a cool location. The best place is in a lower 'tween-deck hold or lower hold. Priorities for selecting locations are similar to those used for magazines.

CHEMICAL STOWAGE

Chemical agents are given the same protection as that required for ammunition stowage. However, stowage in a deep tank or lower hold is preferred. Because of the hazards associated with

leakage, take precautions during the dunnaging operation to seal the pump suction, hatch covers, and ventilators.

SPECIAL STOWAGE

Stow classes of military explosives authorized for special stowage in ventilated space protected from the elements. Insure that the space does not contain vessel stores or machinery or equipment used during the navigation of the vessel. The space should be located so that it can be closed off from traffic while at sea. Locations to be avoided include, for example, deck houses, mast houses, and mast lockers. Use dunnage to protect the explosives from contact damage with the ship's structure.

PORTABLE MAGAZINE STOWAGE

Portable magazines are stowed in a hold or on deck.

PYROTECHNIC STOWAGE

Pyrotechnic ammunition is given ammunition stowage or special stowage away from heat. Protect it from moisture. Except where permitted, pyrotechnic ammunition is not stowed in hold or compartment with other military explosives.

DECK STOWAGE

Most classes of explosive cargo can be stowed

on the weather deck. Typical cargo stowed on deck includes the following.

- Last-on first-off loads which interfere with access to the hatch.
- Items that are too large to fit through the hatches, such as completely assembled missiles or rockets.
- Items that are relatively bulky compared to their weight, such as bomb fins and empty incendiary bombs.
- Flammable liquids, solids, or oxidizing poisons, and combustible liquids (including rocket engines containing a liquid propellant and fuels in containers for guided missiles and rockets).

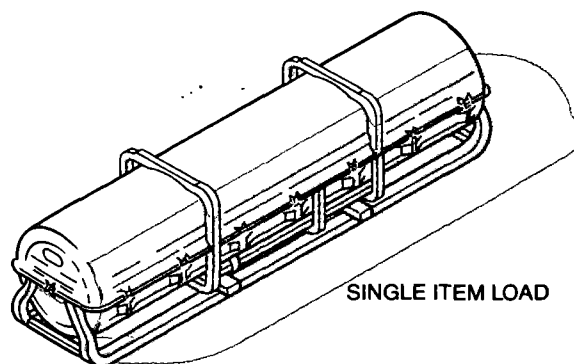
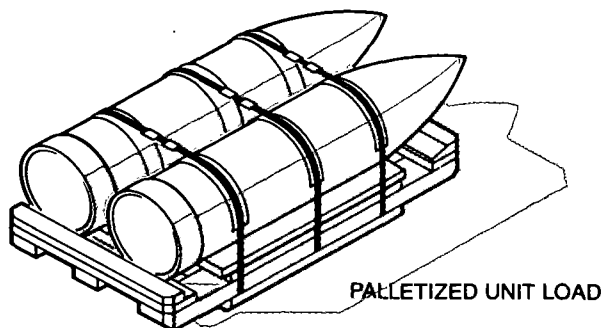
Deck stowage of dangerous items such as flammable or combustible liquids above a hold containing ammunition is very dangerous and should not be done.

The dockside handling procedures for cargo to be stowed on deck are the same as those previously described for cargo stowed in the hold. Often, however, the cargo is positioned on deck with the hoisting gear and then manually stowed. Proper placement of cargo is as important for a tight stow on deck as it is in the hold. To achieve this, the unit loads should touch one another as much as possible.

GENERAL TYPES OF EXPLOSIVE LOADS

The explosives loaded aboard merchant ships are classed generally as rectangular or round. For stowing and securing purposes, loads are grouped as **rectangular unit loads** which are

items unitized on wood pallets, metal pallets, or skids, or as **round, single-item loads** which are large items loaded individually.

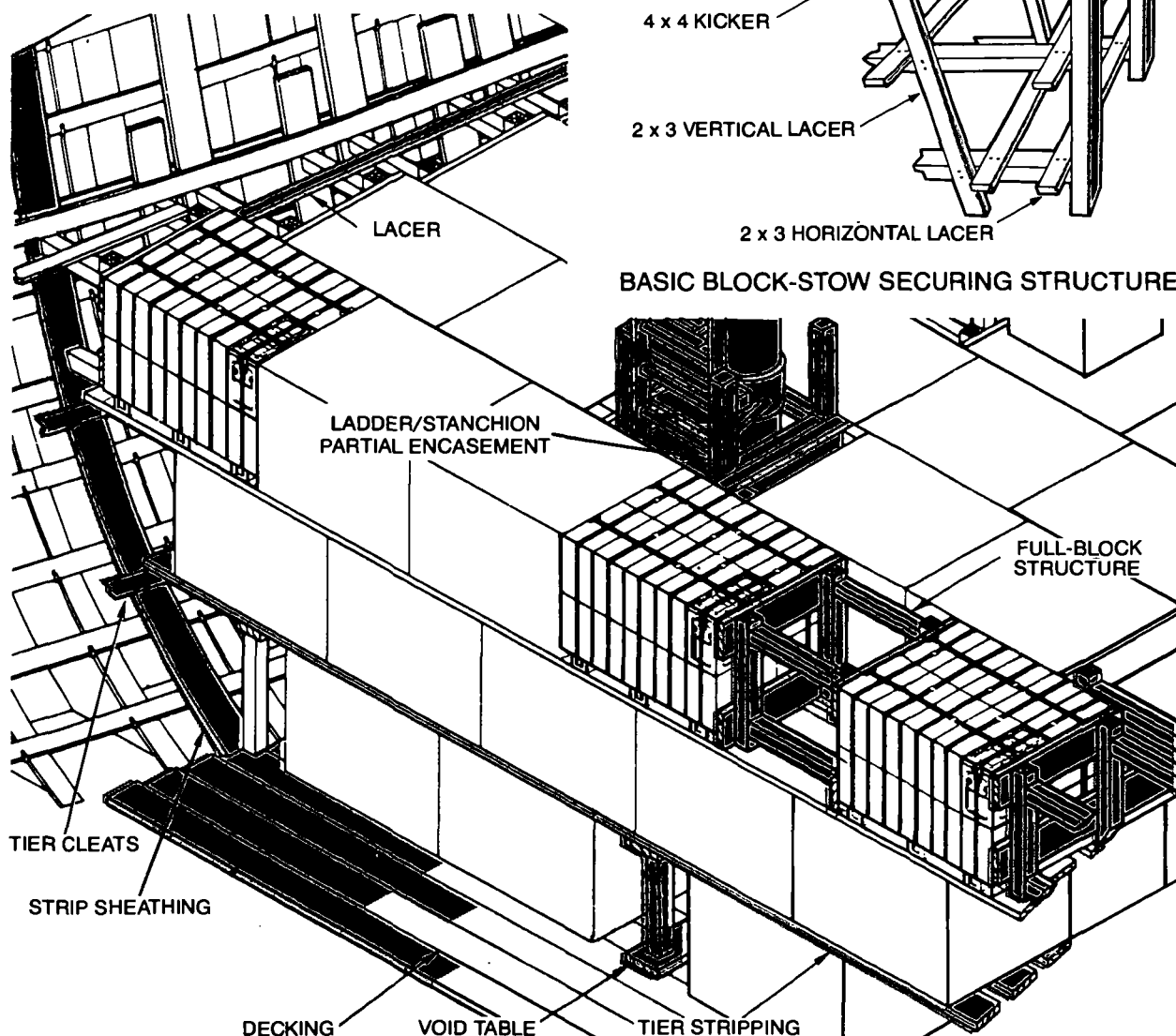


GENERAL STOWAGE PROCEDURES

Explosives are dunnaged below decks using either of the following methods.

BLOCK STOWAGE

Loads are stowed in the form of tight block between both sides of the hold, or they may be confined by other loads or wooden bulkheads if the size permits. Block-stow techniques are best because undesirable void areas within the stow are kept to a minimum.



TYPICAL BLOCK STOWAGE, LOWER HOLD NO. 1

SWEATBOARD-TO-SWEATBOARD STOWAGE

Sweatboard-to-sweatboard stowage uses the most space within a hold. But it also results in a greater number of small empty spaces than block stowage. These features become more pronounced in compartments with severe hull curvature.

In areas approaching a rectangular shape the technique resembles block stowage. Sweatboard-to-sweatboard stowage method provided in compartments with severe hull curvature requires considerably more effort (in terms of manpower and time) than does a straight block stow.

THE SECURING PROCESS

Shifting cargo presents hazards. It may cause damage to the vessel or an explosion. It is important that all precautions be taken to protect the cargo from shock, fire, high temperature, moisture, or any other hazards that could lead to a

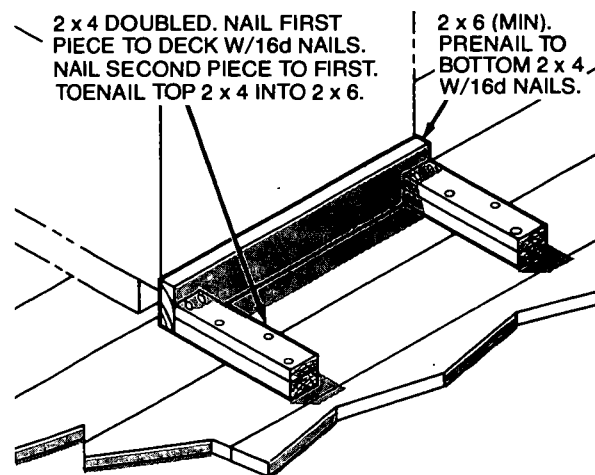
catastrophe. In transit, repairs to dunnaging or resecuring of shifted cargo are difficult and dangerous. The following section covers basic methods used during vessel loading.

FUNDAMENTAL SECURING

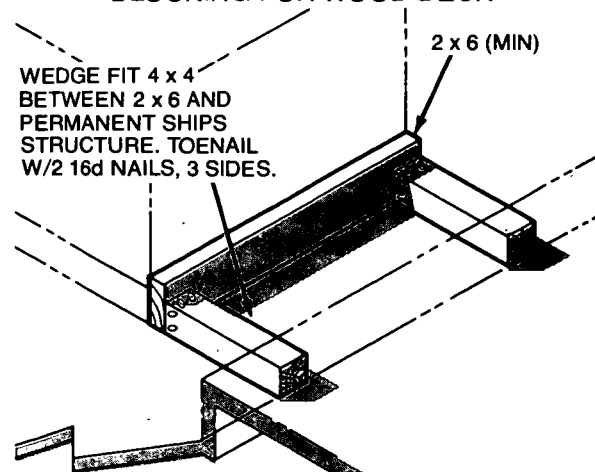
The general terms "securing" and "dunnaging" are used interchangeably to describe the procedures by which military explosives are effectively blocked, braced, and tommed aboard merchant-type ships. This securing or dunnaging is done to resist forces generated by vessel response to sea conditions. Securing includes the various wooden structures used in cargo securement. It also includes any straps or webs that are used to restrain cargo stowed in the holds and on the weather deck of a ship. To describe more specifically the securing process to obtain a secure stow, the terms "blocking" and "bracing" are commonly used. The terms are closely related, although each function is distinctly different.

BLOCKING

Blocking is the act of putting in solid pieces of wood, or blocks, to a deck, bulkhead, or overhead. This is done in such a manner that these pieces lean directly against the cargo and prevent movement of the cargo. Blocking must be braced, shored, or tommed to be effective. Shown here is the basic technique of blocking from which more complex securing structures are developed. Additional bracing would be required to secure the item adequately. Two- by four-inch pieces are doubled instead of using single 4- by 4-inch members to make nailing and securing to the deck possible. The 2- by 6-inch blocking member extends the full width of the unit load. Since



BLOCKING FOR WOOD DECK



BLOCKING FOR METAL DECK

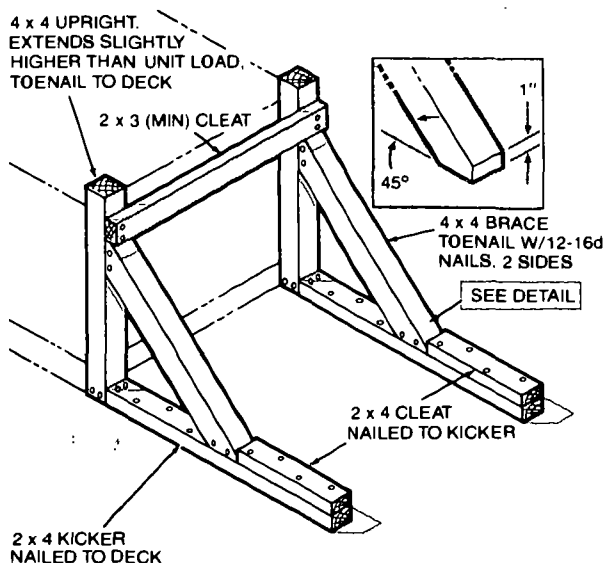
blocking may be nailed directly into the wooden deck, the load may be secured in any location in the hold without the need for extending members to permanent ship's structures for bracing. It is difficult, to say the least, to drive nails into a metal deck. Therefore, 4- by 4-inch lumber must be extended to the bulkhead to provide necessary bracing.

BRACING

Bracing is the act of installing a wood member or structure so that it extends from a deck, bulkhead, or overhead to the stow. This strengthens the blocking by supporting it in a horizontal direction. Shown here is a basic method of bracing. Kickers are relatively short lengths of lumber nailed horizontally. They add rigidity to the uprights and braces and are either nailed to the deck or wedge-fitted to a bulkhead. In both cases, it should be noted the structure extends slightly higher than the unit load and along the full width.

SHORING AND TOMMING

Shoring, which includes blocking and bracing, is the process of securing cargo to prevent side-



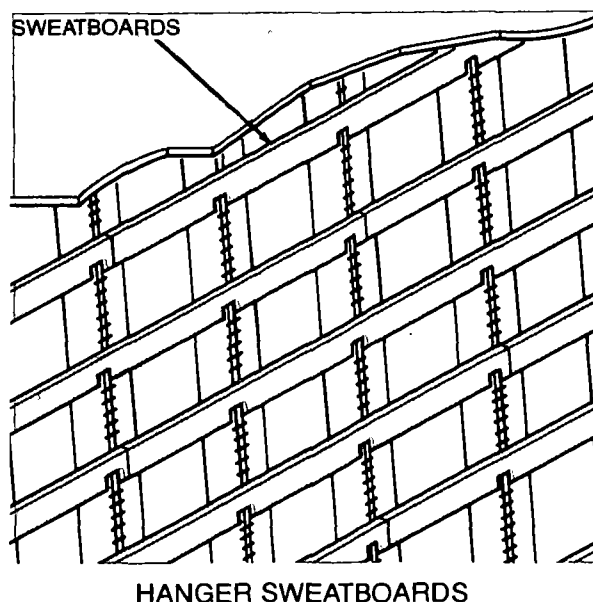
BASIC BRACING FOR WOOD DECK

to-side movement by supporting it from the side. Or it is used to prevent downward movement by supporting it from below. Tomming is the securing of cargo to prevent upward movement. The cargo is secured by running lumber from an overhead ship's structure down to the cargo either vertically or at an angle.

PRELOAD SECURING

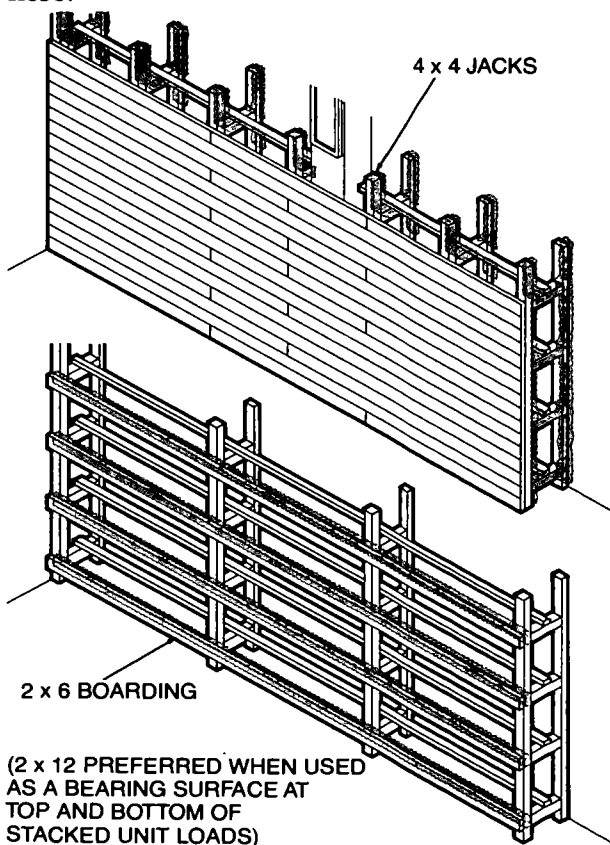
After inspecting and cleaning the hold as required for the loading of explosive cargo, prestow preparation and loading are begun. Considering the stowage requirements of the type of cargo being loaded, structures such as heat bulkheads or sheathing are installed.

Sweatboards (or sweatbattens) are lengths of lumber usually 2- by 6-inch stock, installed in hangers usually bolted over the ship's structural stiffener beams. They are used to prevent damage to the cargo or ship caused by contact of the cargo with the ship's structure and hull. Contact with moisture condensing on the hull plate is also prevented. That's why they are called "sweatboards." Prior to placing the cargo, all missing or damaged sweatboards should be replaced from the ship's stock or with 2- by 6-inch lumber cut to the required length.



Sweatboards bolted in position are more difficult to replace and require drilling holes to receive bolts mounted on the stiffener beams. Sweatboards are not generally used as load-bearing members in the block stow technique. But they are used extensively as bearing surfaces for distributed loads transmitted through strip sheathing when the sweatboard-to-sweatboard method is used.

After preload securing, consider the requirements for bulkhead construction. Heat or non-heat bulkheads are constructed wherever loads are stowed along the ship's athwartship structural bulkheads. Heat bulkheads are tightly constructed to prevent radiated heat, such as heat from engine room, bulkheads, uptakes, or casing, from reaching the cargo. Typical completed heat and nonheat bulkheads are shown here.



In compartments where hull contour is absent or minimal, extensive preload dunnaging is un-

necessary, requiring only that minor obstructions such as latches, pipes, or conduit be protected. In such cases, spacer material is installed prior to stowage.

The spacers are constructed of uprights of a size necessary to obtain adequate clearance. Normally, 4- by 4-inch stock is used for this purpose. Obstructions are boarded over with 3-inch minimum lumber.



The final requirement to be considered in basic prestowage dunnaging is the boarding over or encasement of stanchions, ladders, kingposts, vents, pipes, or beams that could otherwise contact the cargo. Complete encasement has been almost completely abandoned with the introduction of palletized cargo.



STANDARD SECURING STRUCTURES AND REQUIREMENTS

This section describes the types of structures and materials used in securing military explo-

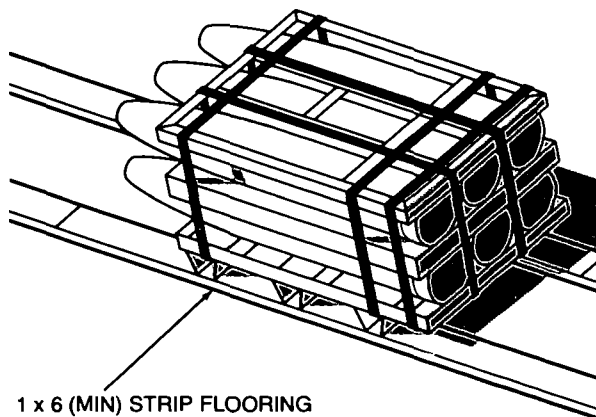
sives. This is for the purpose of preventing movement and damage during transportation.

DECKING

Decking (flooring) is used to prevent a metal-to-metal contact between the deck and the unit load. If not used, it could result in a fire or an explosion. Lay decking is placed over metal decks or tank tops to protect military explosives. Decking is not required when decks or tank tops are coated with the right kind of nonmetallic materials, such as mastic. The entire exterior of class "A" magazines is wood. Therefore, they must be completely floored.

STRIP DECKING

Since the primary purpose of decking is to prevent metal-to-metal contact between the deck and the unit load, it is necessary to install, as a minimum, strip decking. Strip decking is installed in compartments where metal pallets or the strapping of wooden skids bound with metal straps would otherwise contact the deck. Here you can see the use of strip decking, also referred

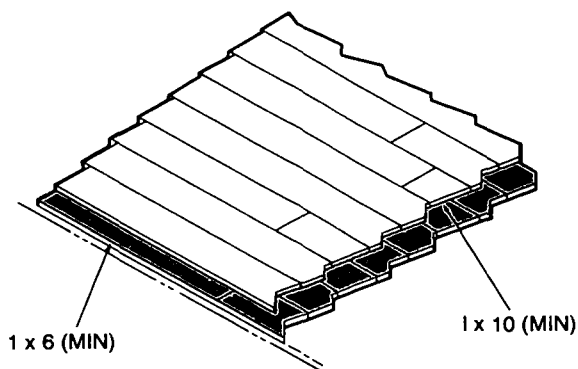


to as strip flooring. Since the strip decking bears only compressive loads, 1- by 6-inch lumber is adequate for stripping purposes. Cut the stripping to appropriate lengths and place under the skids of the unit load. Position the stripping crosswise to the pallet skids to minimize any pos-

sibility of the unit loads being displaced from the stripping in transit.

FULL DECKING

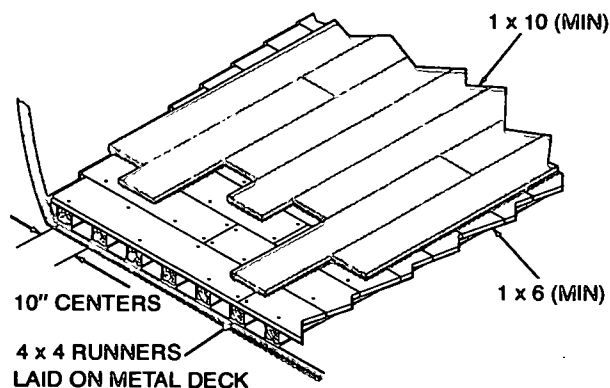
Full wood decking (flooring) is made of lumber not less than 1 inch thick by 10 inches wide. Smaller lumber is more readily displaced and damaged by the wheels of forklift trucks. Two



layers of lumber are used to construct full flooring, provided the layer is not less than 6 inches wide and the top layer not less than 10 inches wide. Decking is laid in crosswise layers if within class "A" magazine. This technique is preferred whenever two-course decking is used. The decking is fitted tightly, edge-to-edge and butt-to-butt. However, adequate space should be left at the hull to permit drainage of condensation runoff.

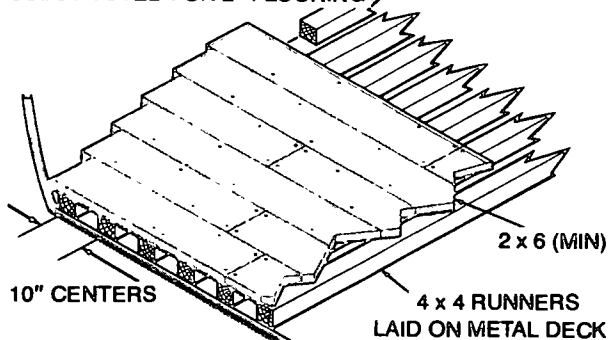
Flooring in the 'tween-deck holds can be made using a single layer of 2- by 10-inch lumber. The floor is laid directly on the deck, edge-to-edge and butt-to-butt. Boards are laid fore and aft or athwartship. However, the athwartship orientation is preferred if the entire hold is to be floored, or if flooring is required only at the curve of the hull. Flooring laid in this manner will closely follow the hull contour with a minimum

of exposed metal deck. If obstructions on the deck prevent the laying of a flush flooring surface, the flooring is lifted on a foundation of 4- by 4-inch runners. Runners are laid fore and aft or athwartships. However, spacing must not exceed 10 inches center-to-center. Leave enough space between runners and the shell plating to allow for condensation run-off.



1-INCH WOOD DECKING ON 4 x 4 RUNNERS

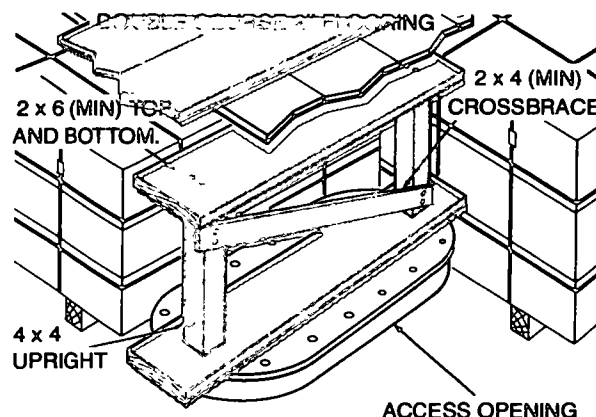
NOTE: 3/4" PLYWOOD MAY BE SUBSTITUTED FOR 2" FLOORING



2-INCH WOOD DECKING ON 4 x 4 RUNNERS

Inspection covers and fill caps often protrude above the deck surface in the lower holds in which the tops of deep tanks form the deck.

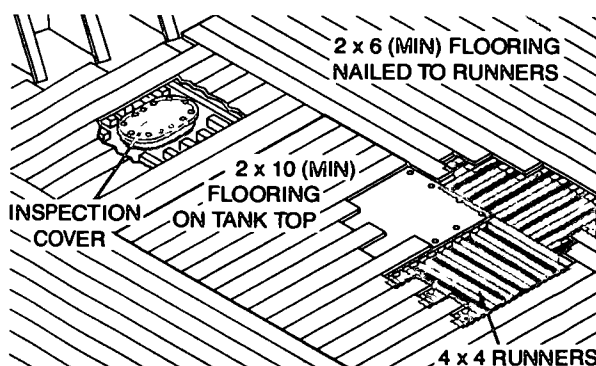
Items not requiring wood flooring, such as unit loads not requiring magazine stowage and palletized on wood pallets, are loaded directly on the deck around the obstruction. A void table block of 4- by 4-inch lumber is constructed around the obstruction and the void block. This unit load will be more than the height of the remainder of the loads stowed directly on the deck. This cre-



NOTE: TABLE HEIGHT
EQUALS LOAD HEIGHT
MINUS OBSTRUCTION HEIGHT

VOID TABLE

ates an uneven surface for flooring. Hence, this method is used when compartment height or characteristics of the cargo do not require that a floor be installed. However, if a floor is necessary above this or other tiers, the stow must be made as level as possible. The surrounding unit loads are stowed in block fashion around the obstruction. A void table is constructed to support the next tier on floor. In some cases the obstructions are so many, making it difficult to work around them. In this case, flooring is constructed

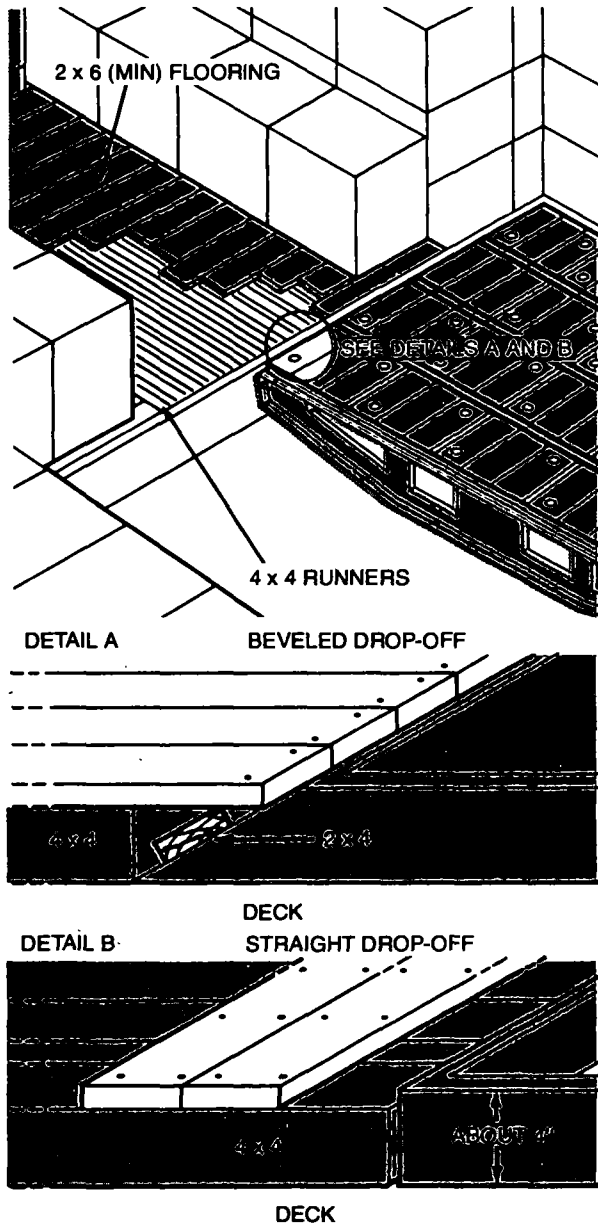


FLOORING OVER TANK TOP

of two 2-inch planks laid on the metal deck. All decking (and runners) should be laid to cover sufficiently any area where forklift truck wheels can reach. However, the decking must not overhang the runners. Runners are not necessary where the tank top surfaces are level and the

flooring is laid directly on the tank top, as required. When used as a stowage area for military explosives, deep tank bottoms are floored over, as required, using the same procedures prescribed for the holds.

In certain holds or compartments, usually high brow plates (raised hatch edges) make necessary the installation of elevated flooring in an area next to the outline of the hatch. This flooring is



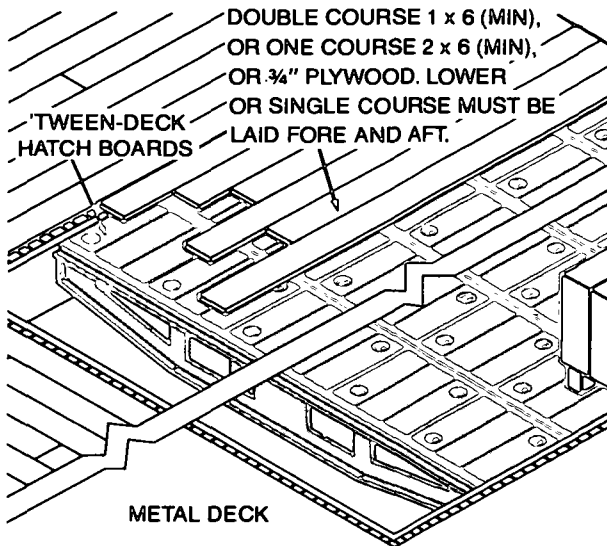
used only in an area large enough to provide a smooth level surface for the safe operation of forklift trucks while stowing unit loads of cargo in an area next to the hatch level. Unit loads stowed fore and aft of the hatch and in the wings of the hold are stowed on the deck or on strip decking only to a short distance from the brow plate or hatch level. This is to permit safe operation of the forklift truck.

At this point the forklifts are removed from the compartment, and elevated flooring is installed. The flooring is usually laid fore and aft at the same level as the hatch. It extends from the brow plate or hatch level to the previously stowed unit loads in the wing and between the unit loads forming the alleyway. Forklift equipment can now complete the brow plate or hatch level in transferring loads from the square of the hatch to the final stowage position on the elevated flooring.

Depending upon the type of cargo being stowed, a space assembly with face boards is required between the unit loads stowed on deck and those on the elevated flooring, due to the difference in height. Such loads have exposed, unsupported strapping and include items such as bombs, particularly those on metal pallets, and irregularly shaped unit loads or containers.

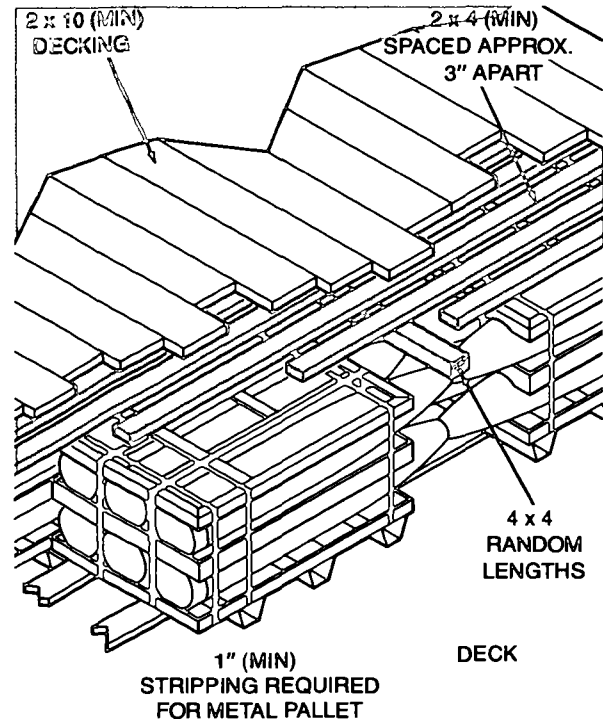
With the increased use of power-operated folding hatch covers on merchant ships, breakbulk ships using 'tween-deck hatch boards are encountered infrequently. However, vessels using hatch boards are still in operation under foreign flag and must be considered. In most cases, however, wood pallets are loaded directly on the hatch boards. Insure that all working surfaces can support the weight of the vehicle and load. Hatch covers, truck-plates, or other temporary surfaces should not shift under pressure or because of movement of the vehicle on it. Therefore, it is necessary to install, as a minimum, a double layer of 1-by 6-inch lumber over the hatch boards. The top course should be laid crosswise to the bottom layer and nailed to prevent free movement. Plywood of minimum $\frac{3}{4}$ -inch thickness or a single layer of 2-inch lumber may be used. However, in all cases the bottom layer of 1-inch material, the

plywood, or the single layer of 2-inch material will be laid lengthwise in the same direction of the centerline of the vessel.



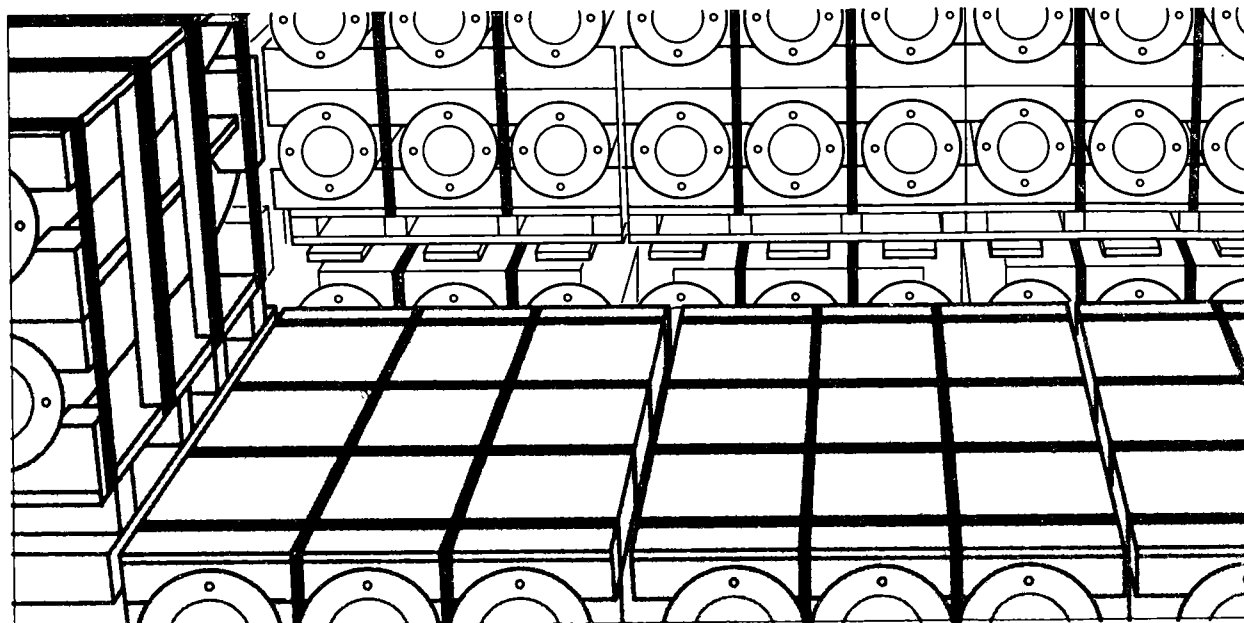
Additional space can be gained for stowing explosives in lower holds bisected by the shaft alley. This is provided flooring is installed. A foundation of 4- by 4-inch members is supported at the center by the shaft alley and at the ends by 4- by 4-inch uprights on 36-inch centers. Double uprights are provided to gain additional lateral clearance with the alley. The cargo floor would extend wing-to-wing.

When cargo is tiered to the height of the operating range of forklift trucks and additional overstow is intended, the cargo is covered over with a tier deck or "machine floor." This floor is made up of two layers of 2-inch lumber. The top layer is not less than 10 inches wide, laid edge-to-edge and butt-to-butt. The lower course is at least 6 inches wide and spaced on intervals of approximately 3 inches. Certain loads, such as explosive bombs, may overhang the pallet or skid. This is so that when loaded nose-to-nose, a space exists between the tops of the loads. In such cases, the lower course of decking is laid lengthwise across the narrowest dimension of the space. Also, as the first course is laid, dunnage such as short 4- by 4-inch pieces cut at random lengths is placed on the loads at points where the decking



would otherwise bear on an uneven foundation. Here you can also see how short lengths of 4- by 4-inch dunnage are placed where the unit loads would not support the decking. The top layer is laid crosswise to the bottom course and nailed enough to make sure it is stable.

Bombs are often loaded nose-to-butt. A lower course of 4- by 4-inch lengths of lumber is laid in the same direction lengthwise of the unit loads. Look at the position of the 4- by 4-inch pieces. Each is placed directly over the bombs to span the void between unit loads. Runners of this type should never be placed between bombs. This would cause compressive loads on parts of the unitized pallet not intended to be pressure-bearing surfaces. The machine floor is particularly important in the stowage of explosives. It forms the foundation for more than one load. It must withstand the concentrated loads of wheeled forklifts while retaining stability. Therefore, voids under the flooring subject to failure in bending must be kept to a minimum. Provisions must be made for the movement of the load to be decked through uprights, particularly when using the block-stow technique.



TIER DECKING FOR NOSE-TO-BUTT BOMB STOWAGE

DUNNAGE FLOORING

When two classes of noncompatible explosives are stored in the same hold one above the other, Federal regulations specify that a dunnage flooring must be installed to separate the classes. Dunnage flooring is classified as either type A or type B.

TYPE A DUNNAGE FLOOR

The type A floor is made of two layers of 1-inch lumber not less than 4 inches in width. These are as much as possible edge-to-edge and butt-to-butt. The top layer is laid crosswise to the lower

layer. A single layer of 2-inch lumber of widths not less than 6 inches is fitted tightly edge-to-edge and butt-to-butt. When using 2-inch lumber over hatch boards, lay the lumber in a fore and aft direction.

TYPE B DUNNAGE FLOOR

A type B dunnage floor is made of a single layer of commercial 1-inch-thick lumber not less than 4 inches wide. It is fitted tightly edge-to-edge and butt-to-butt.

END BULKHEADS

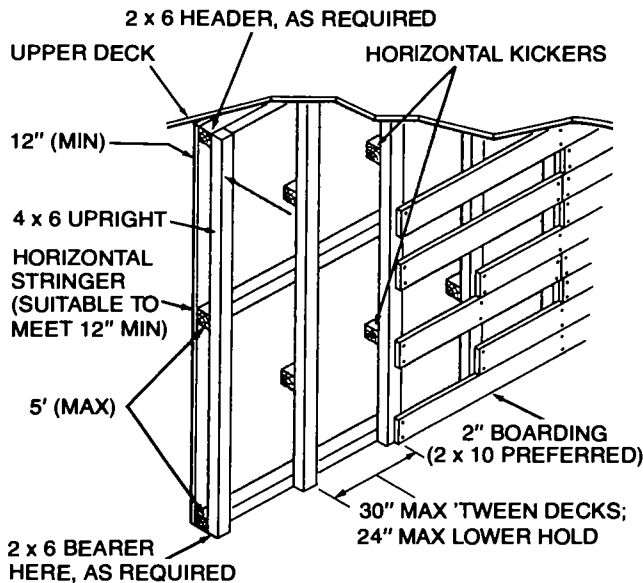
End bulkheads, which must be in place prior to the placing of loads within the stow, can be of either the heat type or nonheat type. Which type is used will depend on the location of the stow with respect to heat-radiating surfaces such as engine-room bulkheads.

HEAT BULKHEADS

Heat bulkheads are recognized by tight, unbroken faceboarding constructed at least 1 foot

off the permanent ship's bulkhead. The smooth side of the bulkhead must always face the stowage of explosives or ammunition. A minimum separation of 12 inches must be maintained between the boarding of the heat bulkhead and the ship's bulkhead.

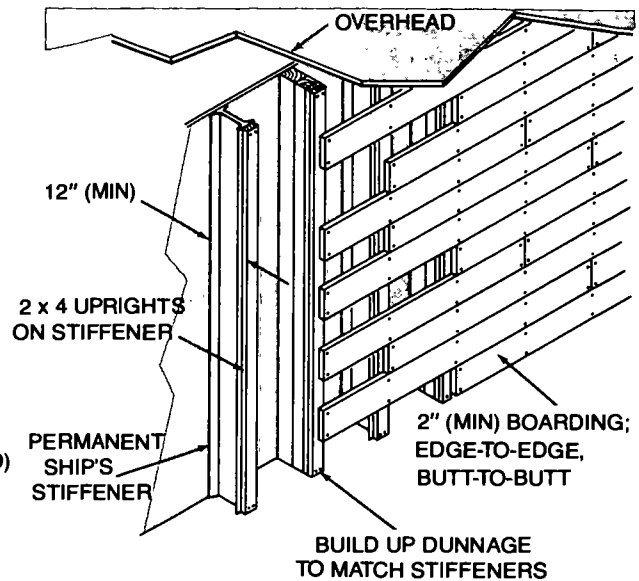
Sheathing is constructed of 2-inch lumber. This is preferably not less than 10 inches in width. Federal regulations require 4- by 6-inch uprights spaced not more than 30 inches apart



HEAT BULKHEAD, SMOOTH SIDE

in the 'tween or shelter deck, or 6- by 6-inch size spaced not more than 24 inches apart in the lower hold. However, it's becoming increasingly evident that there is a shortage of 4- by 6-inch and 6- by 6-inch lumber in the world market. Except for a few instances, use of the more abundant 4- by 4-inch stock may be considered for bulkhead construction. When 4- by 4-inch uprights are used, they are spaced at intervals not exceeding 24 inches between decks or on the shelter deck, or 16 inches in the lower hold. Two by 6-inch lumber is used as necessary for headers and bearers. Bearers are optional if wood flooring already covers the metal deck. Uprights are fastened at the top and bottom to horizontal stringers of suitable size to obtain a 12-inch separation from the upper and lower stringers.

Notice here the heat bulkhead. Uprights (minimum of 2- by 4-inch lumber) are fitted against the stiffeners. Headers are not generally required. Bearers need to be laid only if the metal deck has not been floored over. If the permanent ship's stiffener beams exceed a center-to-center spacing of 30 inches, dunnage should be built up to match the stiffeners, or, as an alternative method, 2½-inch boarding can be used. It is, however, more common and faster to build up dunnage between stiffeners. This is since the 2½-

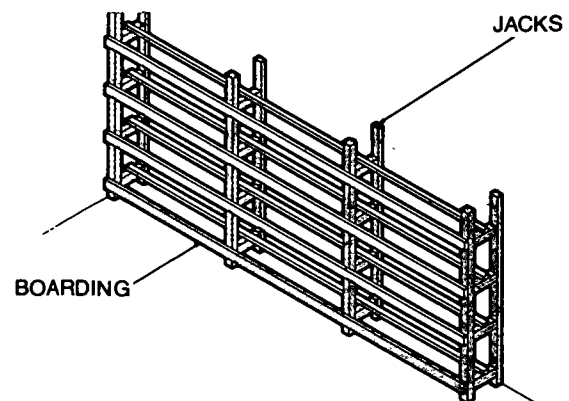


HEAT BULKHEAD, STIFFNER SIDE

inch material is not readily available in many areas. The uprights are sheathed with 2-inch lumber. The lumber should preferably be 2- by 10-inch or 2- by 12-inch stock, or ¼-inch plywood sheets. As an alternative method of heat bulkhead construction, jacks are used to provide the necessary support for the 2-inch boarding. This type of bulkhead is used either on the smooth side or on the stiffener side of the ship's bulkhead.

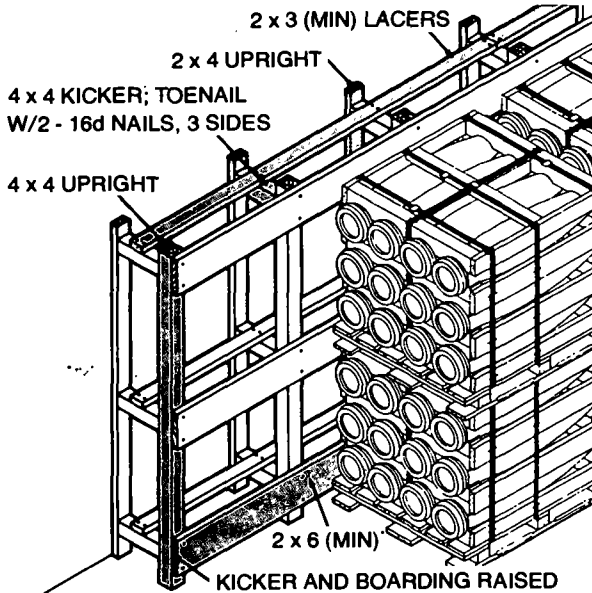
NONHEAT BULKHEADS

Nonheat bulkheads are made in the same manner as the heat bulkheads except that the boarding need not be fitted edge-to-edge.



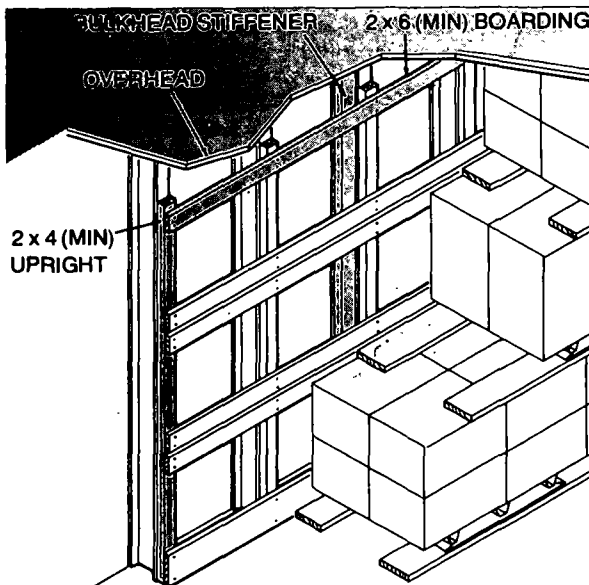
TYPICAL NONHEAT BULKHEAD

The bases and tops of palletized unit loads tiered two-high are properly supported by 2-inch



NONHEAT BULKHEAD USING JACKS

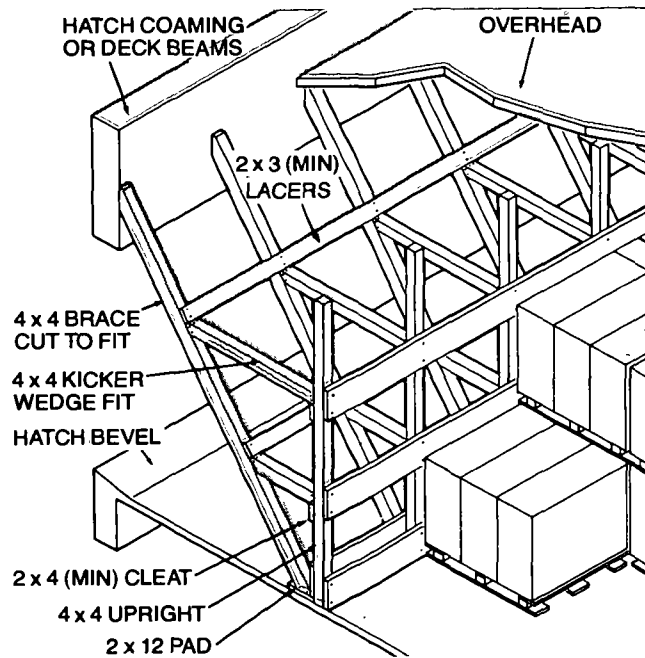
boarding. Several fundamental techniques of securing nonheat bulkheads also apply to structures other than bulkheads. In general, boarding should be vertically spaced to provide a bearing surface for the top and bottom of each unit load in the tier. The space between the centers of up-



NONHEAT BULKHEAD ON STIFFENER SIDE

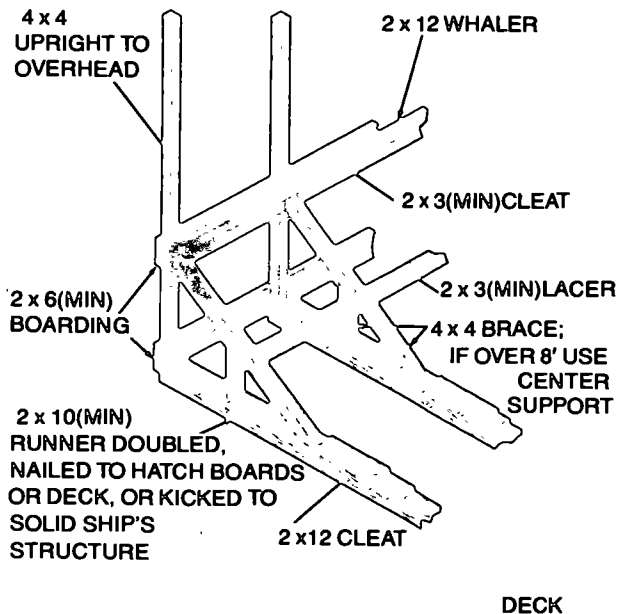
rights should not exceed 24 inches in 'tween-deck compartments or 16 inches in the lower holds. Nonheat bulkheads constructed on the stiffener side of the ship's bulkhead are put together. Uprights of 2- by 4-inch minimum stock are positioned on each stiffener. Boarding is vertically spaced in such a manner as to maintain two-point contact with each unit load.

Stowage ending in an area of a hold where there is no permanent ship's bulkhead to support an end-bulkhead is secured by the use of A-frames. The hatch coaming and deck are used as support points for 4- by 4-inch main braces. Braces and kickers provide the required bracing of the uprights. Braces and kickers are constructed of 4- by 4-inch stock, cut to fit. The structure is securely laced with 2- by 3-inch lumber. Cleats under the kickers are 2- by 4-inch material.

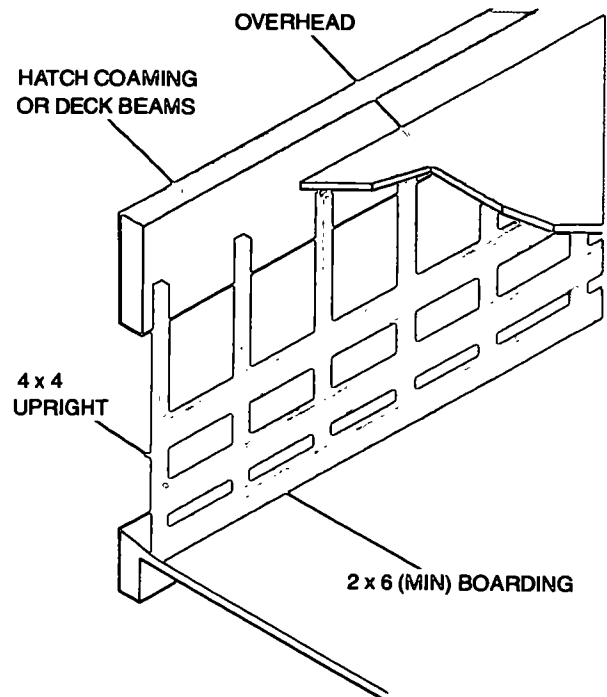


NONHEAT BULKHEAD USING A-FRAME

In cases where the cargo is at such a distance from the coaming as to make A-framing impractical, the bulkheads are braced. Braces bear on the bulkhead at the same level as the top of the cargo. These braces are secured with 2- by 12-inch runners, which are nailed to the deck or



NOTE: BRACE SHOULD RISE 1' FOR EVERY 3' OF LENGTH

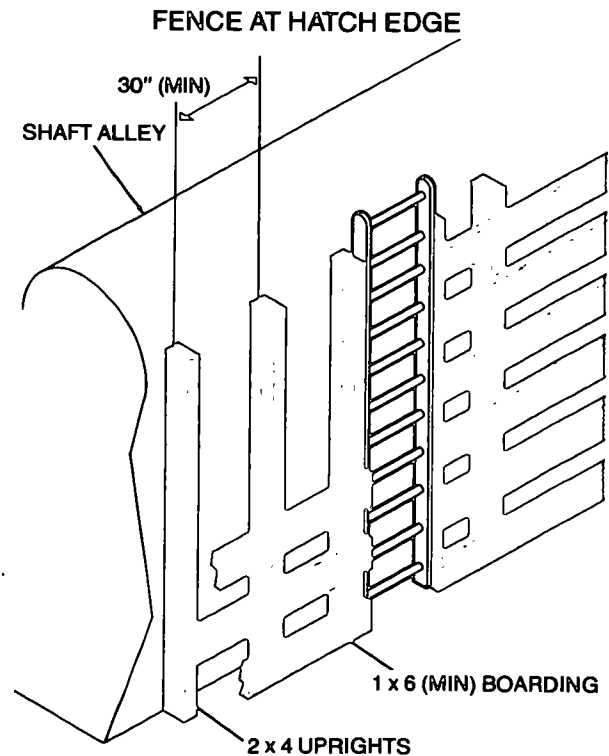


NONHEAT BULKHEAD USING DECK BRACING

wedge-fitted to the ship's solid structure. The length of the bracing member is determined by maintaining a 3:1 ratio (3-foot run to 1-foot rise) when possible. Uprights are extended to the overhead to provide rigidity.

Stowage extending to the level at the hatch edge is secured by nonheat bulkheads. These structures, also known commonly as "fences," are constructed of 4- by 4-inch uprights securely wedged to the overhead, and bearing against the hatch level and coaming. Boarding of 2- by 6-inch minimum stock is secured to the uprights as required by the type and size of the unit load.

Nonheat securing structures are installed in lower holds against the shaft alley. Uprights of 2- by 4-inch lumber with 30-inch maximum centers are cut level with the top of the shaft alley over which flooring is laid to provide additional stowage space.

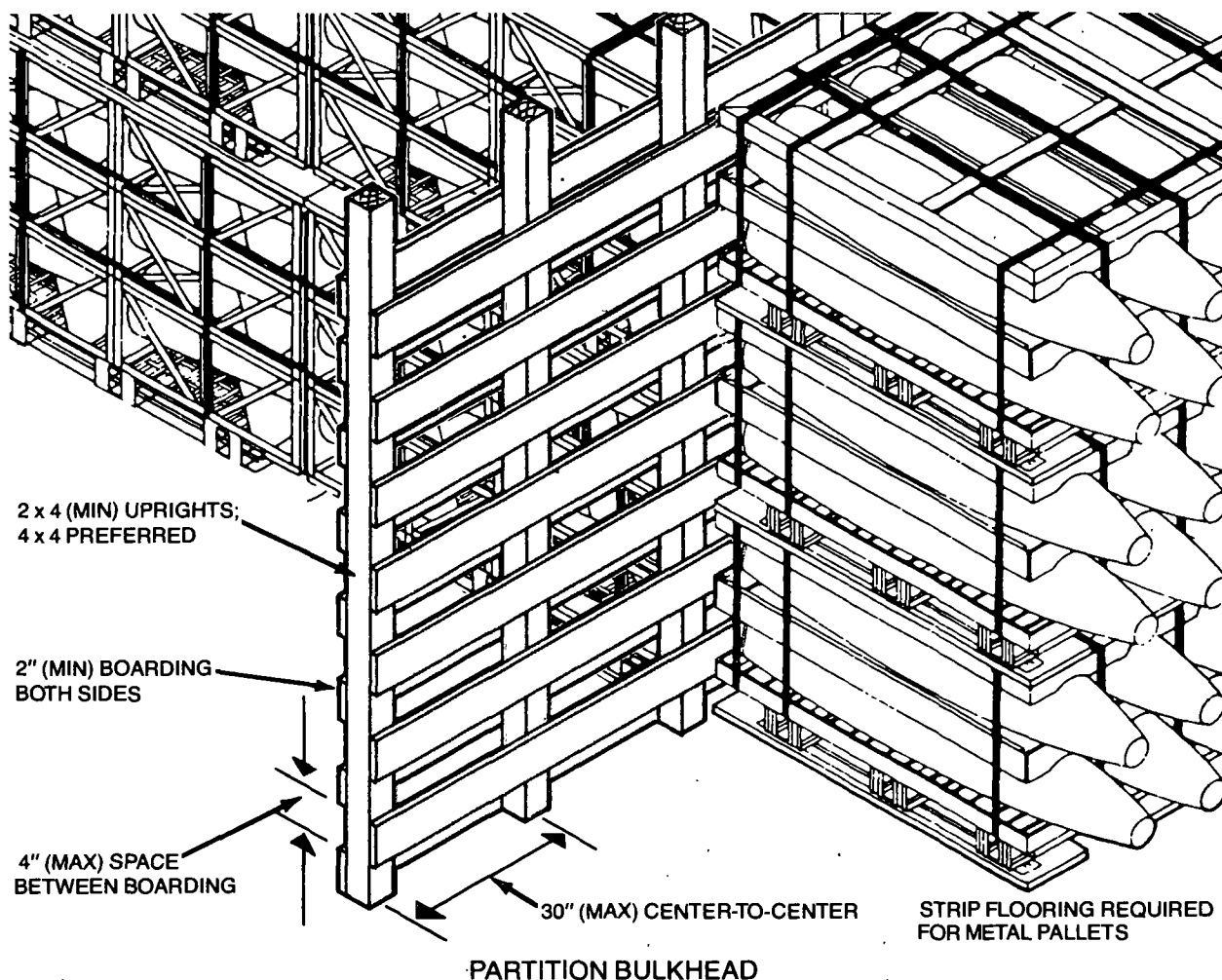


NONHEAT BULKHEAD AGAINST SHAFT ALLEY

PARTITION BULKHEADS

Partition bulkheads are constructed when it is necessary to separate military explosives by type or weight, or because of difference in the packaging construction. This type of bulkhead is constructed of 2- by 4-inch minimum uprights

not exceeding 30 inches in separation. Boarding should be a minimum of 1- by 4-inch material secured alternately on both sides of the uprights and spaced not more than 6 inches apart.



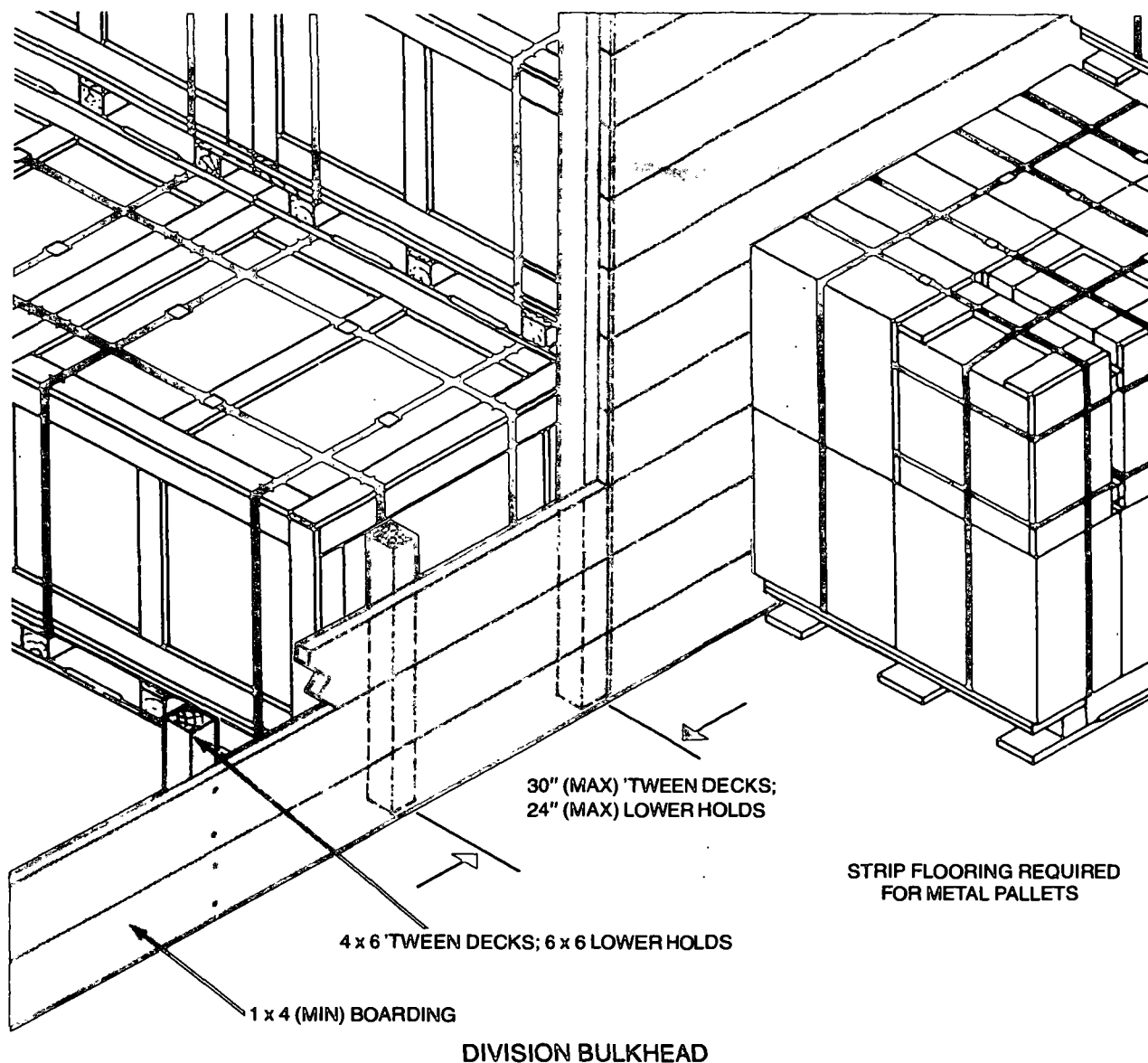
DIVISION BULKHEADS

When the quantity of explosives stowed is not enough to fill the hold or compartment completely, general cargo is loaded in the remaining area. This is provided the explosives are completely separated from the general cargo by means of a division bulkhead. It requires commercial 2-inch boarding secured on 4- by 6-inch uprights spaced not to exceed 30 inches center-

to-center for 'tween-deck compartments or holds. Also, 6- by 6-inch uprights are spaced not more than 24 inches center-to-center in the lower holds. However, general shortages of 4- by 6- or 6- by 6-inch stock often dictate the use of 4- by 4-inch uprights in construction of the division bulkhead. Boarding may be of random widths, although 2- by 12-inch lumber is preferred. A

smooth surface formed by edge-to-edge and butt-to-butt fitting of the boarding always faces the explosive stowage. When use of 4- by 4-inch up-

rights is necessary, spacing must not exceed 24 inches on the 'tween decks or 16 inches in the lower holds.



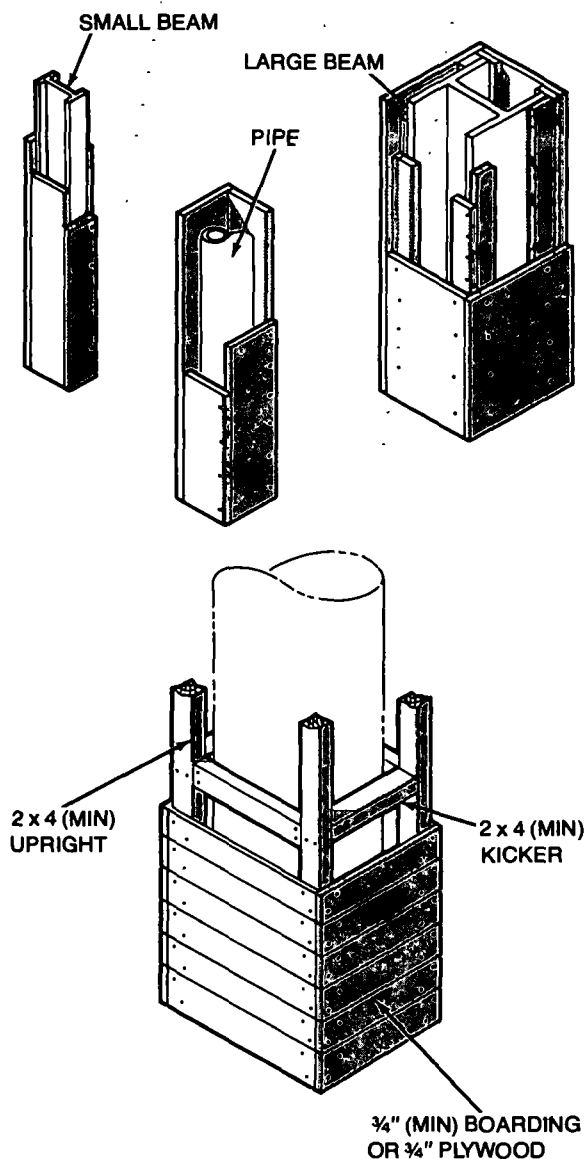
ENCASEMENT

In order to prevent contact of the cargo with the ship's structures such as beams, air vents, conduits, pipes, stanchions, or ladders, these structures are covered with or surrounded by wood material. Encasement is either complete or partial. Requirements for complete encase-

ment have been almost completely eliminated with the introduction of palletized cargo, but encasement is required by Federal regulation if the structure is located within an area intended for magazine stowage class "A."

COMPLETE ENCASEMENT

If a metal stanchion or ladder is located within a class "A" magazine, it must be completely encased with wood of minimum $\frac{3}{4}$ -inch thickness secured with nails or countersunk screws.



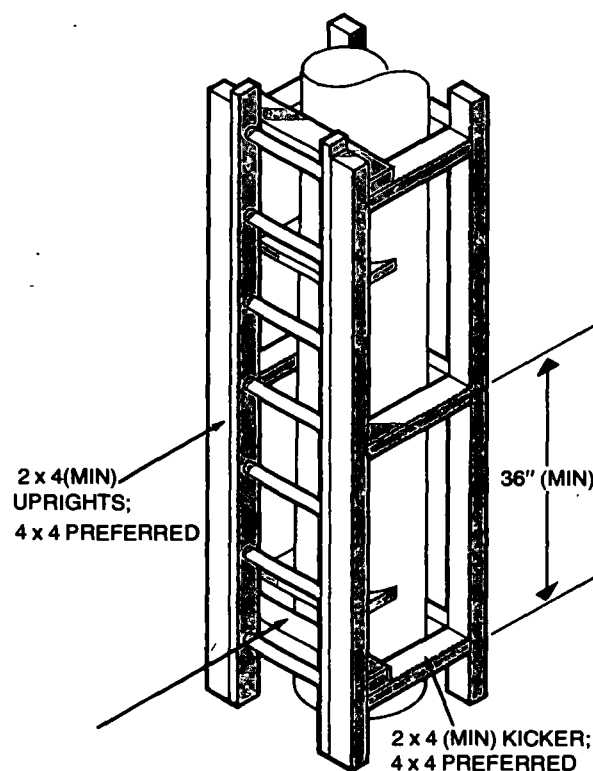
TYPICAL COMPLETE ENCASEMENTS

NOTE: All encasement lumber is $\frac{3}{4}$ inch thick minimum, widths to suit particular application.

PARTIAL ENCASEMENT

Provided the obstruction is not located in a class "A" magazine, partial encasement is used to protect the cargo. Encasement procedures vary slightly, depending upon whether the sweatboard-to-sweatboard method or block stowage is being used.

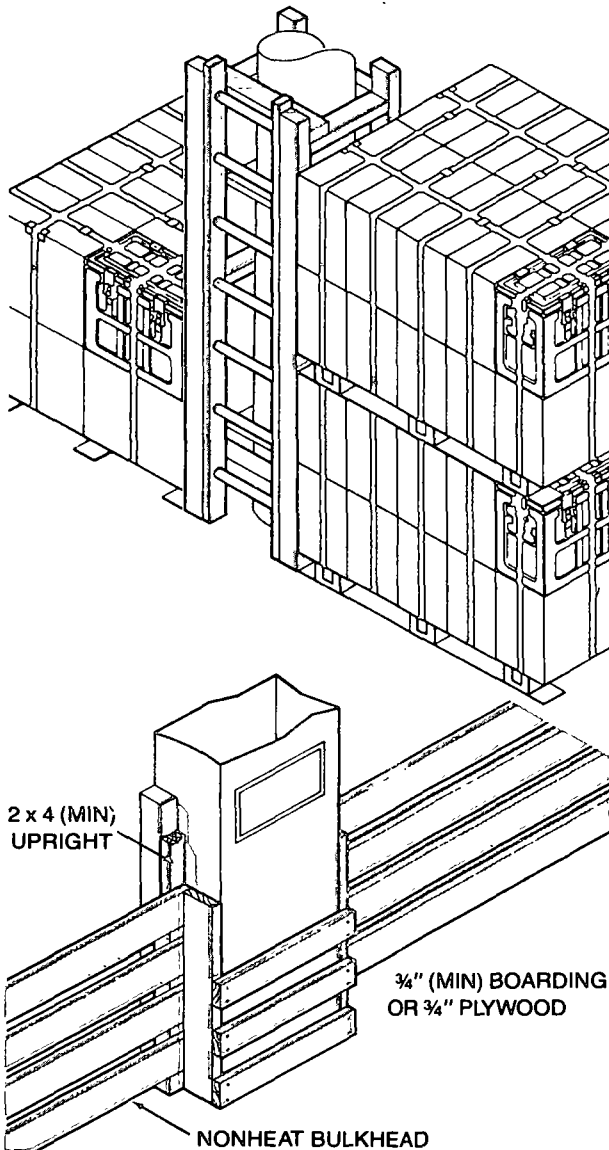
In the sweatboard-to-sweatboard method, obstructions such as ladders and stanchions are first encased as shown here. Unit loads are then



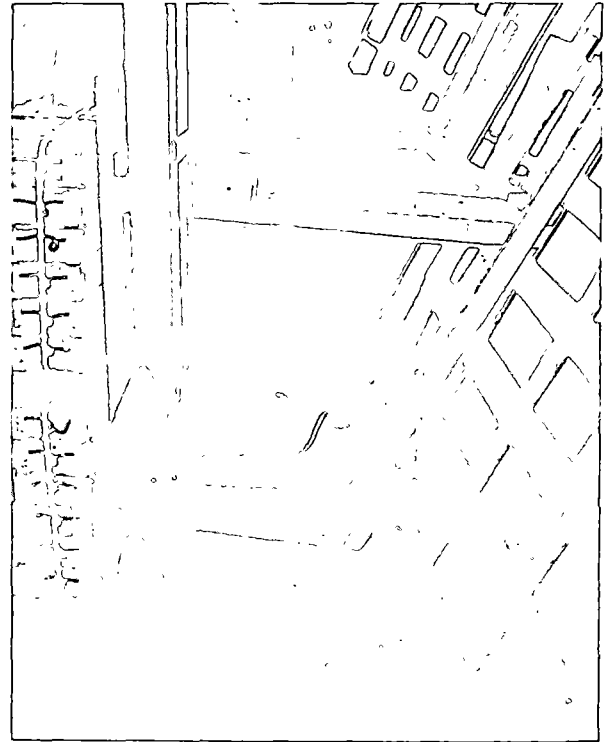
TYPICAL PARTIAL ENCASEMENT

stowed against the encased structure. Uprights are spaced around the obstructions. Each should provide a bearing surface for the cargo. Kickers of similar size stock, spaced not more than 36 inches apart, are used to secure the uprights and unitize the structure. Partial encasement need not be constructed higher than the adjacently stowed unit loads. However, the structure or ladder should remain accessible and available for

use, if necessary. If adjacent stowage of rectangular unit loads is intended, uprights and kickers are constructed of minimum 2- by 4-inch stock. Overhanging unit loads are accommodated by securing boarding of minimum 2- by 6-inch lumber to the uprights at intervals the same as those of the exposed surfaces of the cargo. Finally, the unit load is stowed tightly contacting the encased structure. Note here a typical partial encasement of a stanchion and ladder with a rectangular type of unit load and a partial encasement of an air vent.



When block-stowage methods are used, compartment obstructions such as ladders or stanchions are not partially encased prior to placing the unit loads. Instead, the cargo is stowed in block-form around the obstruction and shored at a later time in the operation. Here is an example of block-stow shoring of a ladder and stanchion



near the hull. In actual practice, stowage of additional unit loads would continue before installation of shoring to achieve maximum stowage rates. Notice that neither the ladder nor the stanchion bears any cargo weight that might result from ship motions. Instead, all forces are transmitted to the ship's structures through the 4- by 4-inch kickers. It should be emphasized that the ship's structures, regardless of appearance, might not be structurally sufficient for support of cargo loads. All stanchions and posts must be examined carefully and protected with full-block shoring if necessary. In no case, however, should access ladders bear cargo loads of any type. Ladders are not intended to be load-bearing structures, and failure under load could result in serious degradation of the stow.

MAGAZINE STOWAGE CLASS A

Federal and US Coast Guard regulations specify certain classes of explosives to be stowed in special portable or nonportable structures known as class "A" magazines. This is to insure adequate segregation and protection of the stow. These magazines may be constructed of either steel or wood. This depends upon the quantity and compatibility of explosives to be stowed in it. The magazine may be of either nonportable or portable construction.

NONPORTABLE CLASS A MAGAZINE

Refer back to the beginning of this chapter for illustrations of construction details for the framework of nonportable class "A" magazines.

The complete boarding over (encasement) of all metal surfaces or structures is a basic requirement of magazine construction to eliminate the possibility of metal contacting metal and causing a spark. The interior of magazines constructed of steel, therefore, must be entirely protected by wood a minimum of $\frac{3}{4}$ inch thick. All ship's structures within magazines constructed entirely of wood including overhead beams or hatch coamings within 12 inches of the top of the stowed explosives will also be boarded over. Bare steel decks within the magazine will be covered with a wooden floor consisting of at least two crosswise layers of commercial 1-inch boarding not less than 4 inches wide. Existing decking need be covered with only one course of dunnage. All flooring should be fitted as close as possible edge-to-edge and butt-to-butt.

In the illustration showing the construction details for the framework of a class "A" magazine constructed along the side of the ship, the horizontal braces (kickers) extend to the hull plate or to strip sheathing secured over the sweatboards. Spacing of the braces must not be over 36 inches. However, the length of the braces will be determined by regulations governing the separation of the class of explosive from the ship's skin. Uprights will not be stepped directly onto a metal deck. Instead, a 2- by 4-inch header will be fitted between the overhead and the tops of the uprights.

During construction, take care to insure that nails do not penetrate into the magazine and that the interior boards are fitted and finished to form a smooth surface. When a metal stanchion, post, or other obstruction is located within the interior of the magazine, cover it completely with wood of at least $\frac{3}{4}$ -inch thickness. Secure with nails or countersunk screws.

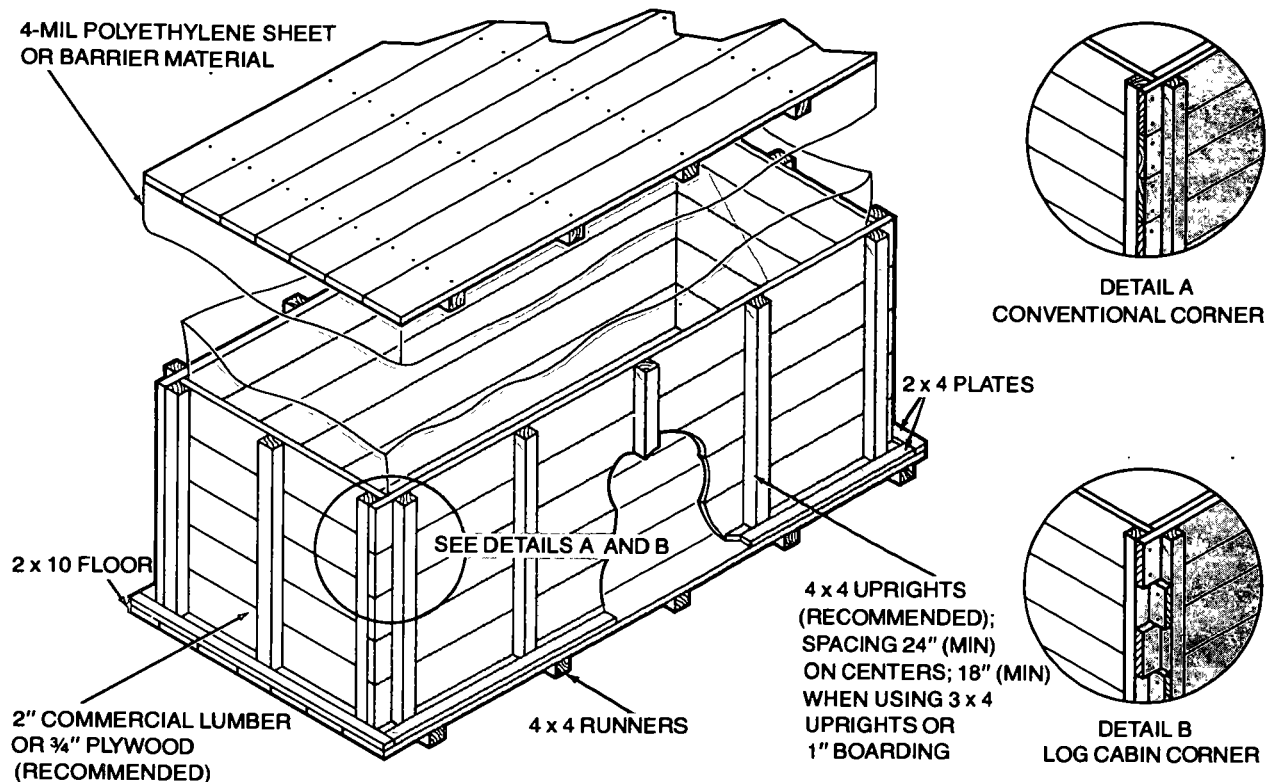
Bulkheads forming the sides and ends are constructed of commercial 1-inch lumber, of $\frac{3}{4}$ -inch tongue-and-groove sheathing, or of $\frac{3}{4}$ -inch plywood secured to uprights of at least 3- by 4-inch stock, preferably 4- by 4-inch spaced on 18-inch centers. Uprights are spaced on 24-inch centers if $\frac{3}{4}$ -inch plywood is used.

When a class "A" magazine measures more than 40 feet in any direction, a partition bulkhead is installed so as to divide the stowage area approximately in half. The bulkhead should extend from the deck at least to the top of the stow. Boarding should be spaced not more than 6 inches apart, alternately on both sides of the uprights.

PORTABLE CLASS A MAGAZINE

Portable magazines are made for stowage of certain classes of explosives. These magazines are constructed of wood or metal lined with wood of $\frac{3}{4}$ -inch minimum thickness. Not more than 100 cubic feet plus 10 percent of explosives (gross) are stowed in a portable magazine.

When constructed of wood, the general materials and dimensions will not be less than those required for a nonportable type "A" magazine. It is recommended that only 4- by 4-inch uprights be used in construction of the magazine runners, uprights, and cover support members. Spacing of uprights must not be more than 24 inches on centers if 4- by 4-inch material is used. The magazine shell is constructed of a single course shell of minimum 1-inch commercial lumber, although 2-inch material is recommended for added rigidity. Plywood sheathing $\frac{3}{4}$ inch in width or $\frac{3}{4}$ -inch tongue-and-groove are also acceptable for construction of the shell. All inner surfaces of the shell should be smooth and free of nails, screws, or other projections.



PORTABLE CLASS A MAGAZINES.

After completion of the basic magazine, the magazine interior and cover are protected with a moisture barrier of polyethylene or waterproof paper at least 0.004 inch thick. The barrier material must be installed as a single piece. However, overlap of pieces is sometimes necessary.

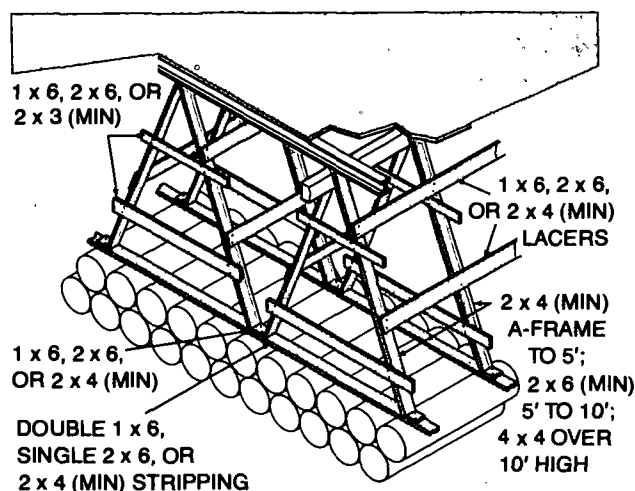
Water runoff will be directed toward the magazine exterior by overlapping the bottom piece over the top piece. Portable magazines stowed in hold where protection from the weather is not a factor do not require moisture-barrier construction.

TOMMING

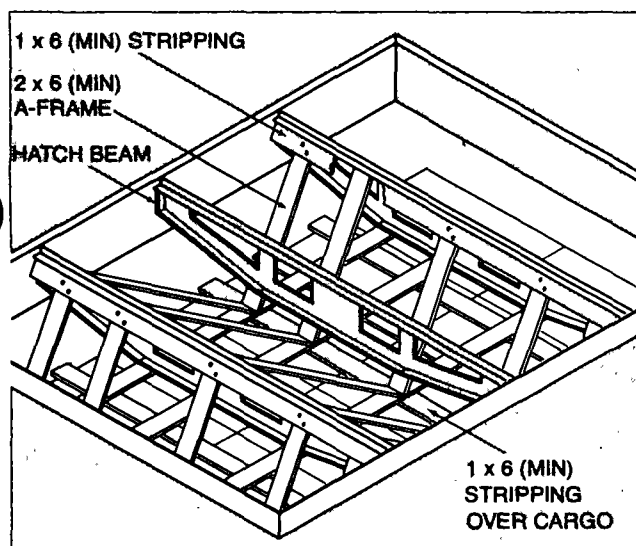
Light items easily bump each other in heavy seas and therefore require overhead securing known as tomming. Tomming is accomplished by tying down overhead ship's structures to the cargo. Overhead bracing frequently uses the A-frame to provide vertical securement. Strips of lumber are laid on the stowed items and serve as the foundation for the A-frames. This also prevents items from bumping together.

Shown on the following page are construction details for A-frame tomming. To prevent excessive flexing of the frame members as height of

the frame increases, the required lumber must be similarly increased. In most cases, 2-by-6-inch stock is used to construct the A-frame. When the height of the overhead exceeds 10 feet, legs of the frame should be constructed of 4-by-4-inch lumber. The angle of the frame, as measured between legs at the vertex, should not exceed 45 degrees. Legs of the A-frame greater than 3 feet in length must be joined with crossmembers. When the length of the leg does not exceed 6 feet, a single crossmember may be used. This should be secured an equal distance from the end of the joined legs. Legs greater than 6 feet in length



OVERHEAD A-FRAME TOMMING

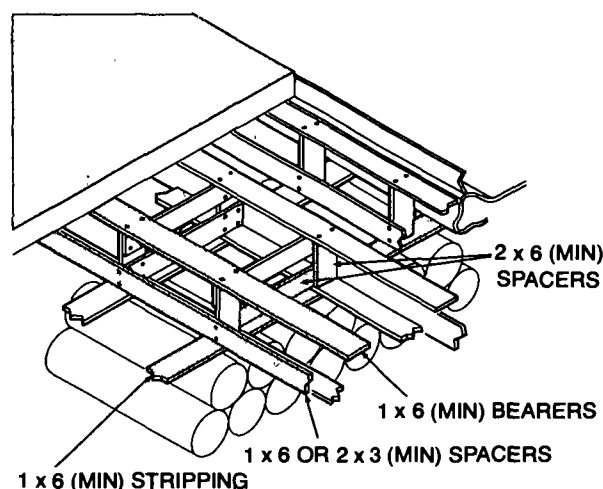


TOMMING UNDER 'TWEEN DECK HATCH BEAMS

will be joined by two crossmembers secured at points one-quarter of the length of the leg from either end. The frames are fastened to double 1-by 6-inch or single 2-by 6-inch lumber strips placed over the cargo. Adjacent A-frames may be unitized by means of 2-by 6- or 2-by 3-inch horizontal lacers.

Shown below are construction details for A-frame tomming under 'tween deck hatch beams. While hatch boards are not used often, the method is still described here. Load-bearing sections of the A-frame are constructed of 2-inch lumber. However, 1-inch material is acceptable for stripping purposes.

Here you can also see how cargo stowed in the square of the hatch is tommed. The hatch cover must then be locked in place to provide the overhead support for the tomming structure.



TOMMING IN SQUARE OF HATCH

STEPPING DOWN A LOAD

In some cases, particularly in the upper 'tween decks when the vessel loading is nearing completion, it may be necessary to reduce the number of tiers or layers of cargo as the stow progresses toward the center of the compartment. This technique is known generally as "stepping down."

Normally the stowing process will proceed at the same time from the fore and aft bulkheads and the wings. This will be done working toward

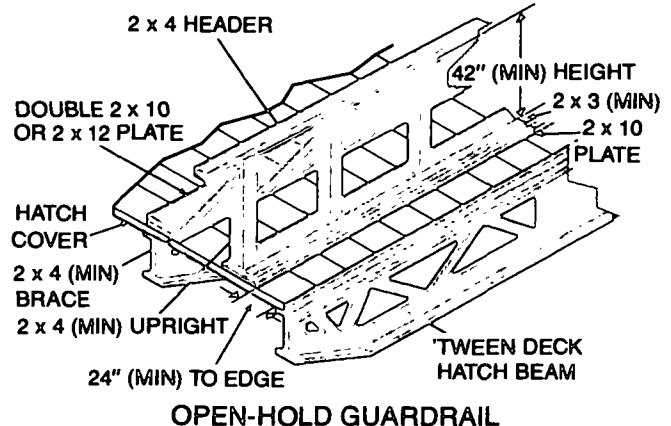
the center of the hatch. If the stepping down procedure is to be used, a securing structure similar in construction to a partition bulkhead is erected. This is done by positioning 4-by 4-inch uprights against the tiered unit loads near each end and by lacing these with 2-by 3-inch or wider material. The unit load is then placed against the uprights. The stowage is then completed by the central area being loaded last with remaining smaller or irregularly shaped unit loads. Full

block securing is used to shore any void remaining in the stow. It may be necessary to brace the structure with diagonal members for added support. This depends upon the volume or weight of the cargo in the multiple tiers or layers behind

the step-down structure. Effective preload planning is necessary to efficiently use the deck space in the center of the compartment with the remaining cargo.

OPEN-HOLD GUARDRAIL

Military explosives are not loaded or unloaded in the hatch at the same time that other cargo is being worked in any hold served by that hatch. In addition, all 'tween deck hatch covers must be in place before the cargo can be worked in a compartment below which military explosives are stowed. In some cases during the loading of a ship, however, it is necessary for personnel to be present to assemble prefabricated structures or to install preload dunnaging, while loading operations are proceeding in the next lower level. To protect the personnel, a guardrail is made across the open 'tween deck hatch. The guardrail extends the full width of the hatch. It is located a minimum of 2 feet from the edge of the open hold. A minimum rail height of 42 inches above the hatch boards is required. The double 2- by 10-



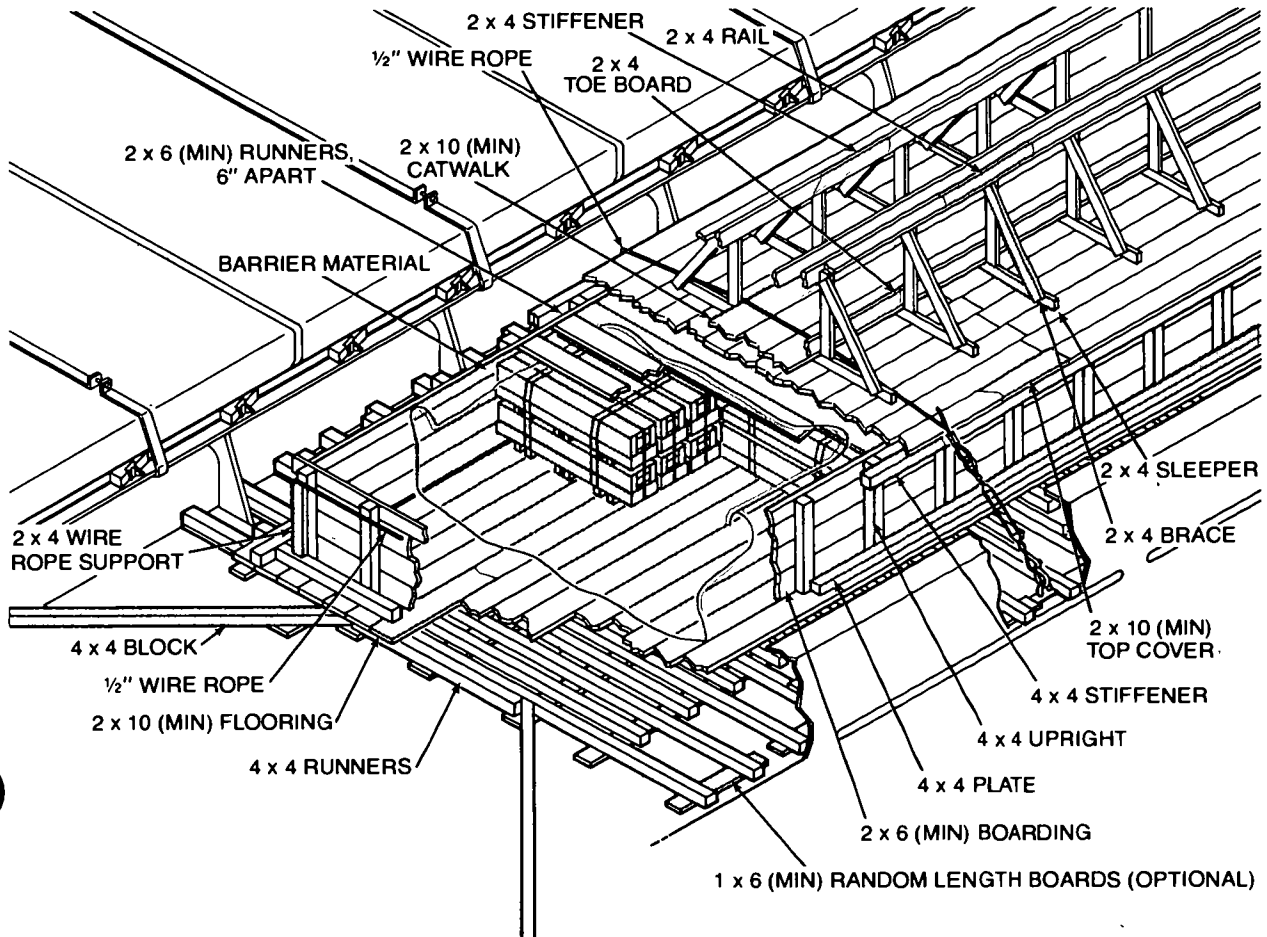
inch plate at the base of the bracing acts as a positive stop for forklift trucks so they don't move toward the open hatch.

DECK-STOW SECURING

Unit loads that are to be stowed on deck must be protected from direct rays of the sun and exposure to the elements. When the explosive's container is of such construction as to provide adequate protection, an open deck-stow structure is permissible. Other more sensitive items are required to be stowed in closed structures. Site of construction on deck must not be situated within 20 feet of an incinerator or ash hoist or any other heat or spark-generating source.

The closed deck-stow structure is made primarily of 2-inch lumber. It is securely braced to adjacent permanent ship's structures. Random-length lumber of 1- by 6-inch minimum size is first laid upon the metal deck to elevate slightly the entire structure. This is to permit deck water to drain. Runners of 4- by 4-inch stock are laid directly on the deck boards and form the foundation of the structure. Construction goes in a similar manner to that of a portable class "A" magazine. A course of 2- by 10-inch minimum

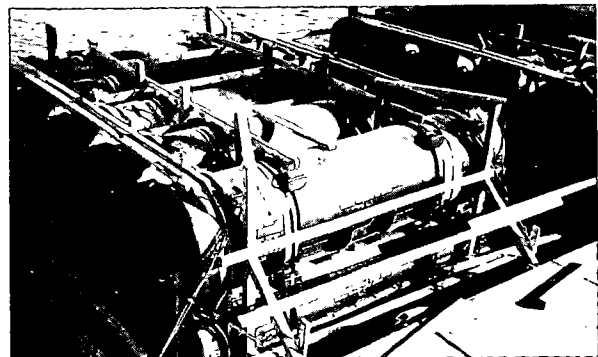
flooring is laid and securely nailed to the 4- by 4-inch runners. The walls of the structure are constructed of 2- by 6-inch minimum lumber secured to 4- by 4-inch uprights. Suitable waterproof barrier material is used to line the interior of the structure. After placing of the cargo and the final covering with barrier material, a single course of 2- by 6-inch minimum runners spaced at intervals not exceeding 6 inches is laid on top of the barrier material. The top of the structure, constructed of 2- by 10-inch minimum lumber, is installed and securely nailed to both the side structures and the 2- by 6-inch runners. Finally, a catwalk, if required, is constructed for access to either side of the stowage area. After installation of enough 4- by 4-inch blocking to adjoining coamings or bulkwarks, the entire structure is placed upright and put together by means of ½-inch wire rope cables passed over the construction. It is secured with turnbuckles. Only appropriate padeyes or



lashing points will be used for this purpose. Guardrails or other structures not designated as lashing points will not be used.

When cargo is packaged in containers providing adequate protection from the environment, an open deck-stow structure is used. Open-type construction is sufficient. It consists of 2- by 10-inch minimum horizontal stiffeners and 4- by 4-inch uprights. Bearing plates of 4- by 4-inch stock are laid along the uprights at the deck to provide a surface to which 4- by 4-inch bracing members may be extended as in the closed structure. This is to permit deck wash drainage. The interior of the stowage area need not be floored if the unit loads have been palletized on wooden skids. For metal pallets, 2- by 10-inch minimum flooring is installed over and nailed to 4- by 4-inch runners laid on 10-inch centers.

Here is an example of another type of open deck stowage. The item is packaged in a specially designed container that has been treated with a protective (heat-resistant) paint that cannot be penetrated by salt spray. The container is also equipped with attachments designed just for securing. Prior to loading the item, risers made of



a double thickness of 2- by 10-inch minimum boarding are laid on the metal deck athwartship and placed so as to have direct and full contact with the container skids. The containers are tiered two high, strapped together prior to loading, and are placed on the deck in groups separated from adjacent groups by a minimum distance of 3 feet. This spacing permits ready application of the various securing materials. It is a requirement of the particular item.

As each tiered unit load is positioned, spacers are placed adjacent to the lifting bracket near each end of the container and laced together with 2- by 4-inch minimum material as shown. These spacers are constructed of 4- by 4-inch uprights,

and cut to a length extending slightly above the height of the unit load. After placing of the final unit load, a single thickness of 2- by 10-inch minimum lumber of sufficient length to span the entire grouping is laid across the top at each end of the container. A suitable barrier material is placed on the unprotected sides of the container at the point where the banding material would otherwise make contact and cause chafing of the container. The whole group is then banded together with the 2-inch banding material on the center of the 2- by 10-inch lumber and barrier material. Uprights and braces of 4- by 4-inch stock are then installed and laced together and the $\frac{1}{2}$ -inch lashing cable attached.

SUMMARY

Keeping dangerous cargo from shifting in heavy seas prevents breakage and spillage of cargo. A hundred gallons of sulfuric acid running free against the side of a steel ship's hull is a disaster in its early stages. Similarly, a load of explosives can be touched off by the concussion of one unit slamming against something. The lives of everyone aboard may depend on how well the dangerous cargo is loaded and secured. A spark from a piece of metal can do the same thing. It's hard to think of a 1-inch nail as being a fuse, but it can be. Dangerous cargo must be protected from metal. A third possible "fuse" we

discussed is heat. As most sailors and terminal operators know, the bowels of a metal ship in summer are like a sample of the lakes of hell. This intense heat plus the heat from the engine and other machinery can be enough to cause an explosion. Protection from this heat is another critical factor in stowing dangerous cargo. As you have seen, the facts in this chapter have been rather "dry." Nonetheless, they are all important. Study the following table and familiarize yourself with the construction techniques summarized there. Your life could depend on knowing them.

**COMPARISON OF APPROVED CONSTRUCTION TECHNIQUES
WITH ALTERNATE METHODS**

REGULATION NO.	APPROVED CONSTRUCTION TECHNIQUES AND MINIMUM LUMBER SIZES	ALTERNATE CONSTRUCTION TECHNIQUES FOR OTHER LUMBER SIZES
46CFR146.29-11 (c) (19)	Division bulkheads, tween-deck compartments or holds. Commercial 2-inch boards secured to 4- by 6-inch uprights spaced 30 inches or less center-to-center. Random-width boards fitted edge-to-edge and butt-to-butt. Division bulkheads, lower holds. Commercial 2-inch boards secured by 6- by 6-inch uprights spaced 24 inches or less on centers. Random-width boards fitted edge-to-edge and butt-to-butt.	Uprights can be constructed of 4- by 4-inch lumber when 4- by 6-inch lumber is not available. Spacing must be reduced to 16-inch centers to provide comparable rigidity. Uprights constructed of 4- by 4-inch lumber when 6- by 6-inch lumber is not available. Spacing must be reduced to 16-inch centers to provide comparable rigidity.
46CFR146.29-11 (c) (20)	Dunnage. Not less than 1-inch commercial thickness laid over tank tops, decks or against bulkheads, frames, ladders, or used for filling voids, or fitted around cargo.	Use of less than 1-inch lumber for general dunnage not permitted.

COMPARISON OF APPROVED CONSTRUCTION TECHNIQUES WITH ALTERNATE METHODS (CONT)

REGULATION NO.	APPROVED CONSTRUCTION TECHNIQUES AND MINIMUM LUMBER SIZES	ALTERNATE CONSTRUCTION TECHNIQUES FOR OTHER LUMBER SIZES
46CFR146.29-11 (c) (63)	Partition bulkhead. Commercial 1-inch lumber of widths not less than 4 inches, secured alternately on both sides of the uprights and spaced not more than 6 inches apart. Uprights at least 2 by 4 inches, spaced not more than 30 inches apart.	Uprights can be constructed of 4- by 4-inch lumber when 2- by 4-inch lumber is not available. Upright spacing will not exceed 30 inches between centers.
46CFR146.29-11 (c) (63)	Type A dunnage floor. Two layers of commercial 1-inch dunnage of widths not less than 4 inches fitted as close as possible, edge-to-edge and butt-to-butt. The top course is laid crosswise to the lower course, or a single layer of 2-inch lumber widths not less than 6 inches is fitted as close as possible edge-to-edge and butt-to-butt. When using 2-inch lumber over hatch boards, the lumber will be laid fore and aft.	Alternate construction not permitted.
46CFR146.29.11 (c) (64)	Type B dunnage floor. One layer of commercial 1-inch dunnage of widths not less than 4 inches fitted as close as possible, edge-to-edge and butt-to-butt.	Alternate construction not permitted.
46CFR146.29.61 (b)	Stowage with nondangerous cargo in same hold. When nondangerous cargo is to be stored adjacent to exterior of magazine, use wooden cargo battens of not less than commercial 2- by 4-inch size, spaced not more than 12 inches, center-to-center, fitted horizontally to uprights forming frame of magazine.	Alternate construction not permitted.
46CFR146.29.75	Location of magazines and ammunition stowage. In insulated spaces normally comprising refrigerator spaces, pipes within compartment will be protected by horizontal cargo battens of a size not less than commercial 2- by 4-inch size, spaced not more than 12 inches apart, center-to-center, and secured to 4- by 6-inch uprights spaced not more than 36 inches apart.	Minimum 4- by 4-inch uprights can be used when 4- by 6-inch stock is not available. Spacing of uprights must be reduced to 24 inches for comparable strength.
46CFR146.29-81 (b)	Magazine Stowage A: Magazines constructed of steel will have the whole of the interior thoroughly protected by wood dunnage of a minimum thickness of $\frac{3}{4}$ inch. Metal stanchions within magazine will be boxed with wood of a thickness not less than $\frac{3}{4}$ inch. When bare steel decks or tank tops are used for magazine floor, a wooden floor consisting of two layers of commercial 1-inch-thick dunnaging will be laid, the top course being laid crosswise to the lower course. When steel decks or tank tops are originally fitted with a wood floor or are ceiled, it will be necessary to fit one course of dunnage.	Deviation not permitted. Do. Do.

COMPARISON OF APPROVED CONSTRUCTION TECHNIQUES WITH ALTERNATE METHODS (CONT)

REGULATION NO.	APPROVED CONSTRUCTION TECHNIQUES AND MINIMUM LUMBER SIZES	ALTERNATE CONSTRUCTION TECHNIQUES FOR OTHER LUMBER SIZES
	All flooring formed by these methods will be laid with commercial 1-inch lumber of widths not less than 4 inches, fitted as close as possible, edge-to-edge and butt-to-butt.	Commercial 2-inch lumber not less than 6 inches wide can be used when available.
46CFR146.29-75 (b)(1), (2), (3)	Construction of magazine to stow ammunition adjacent to engine room, boiler room, or coal bunker bulkheads, or engine or boiler room uptakes or casings. Construction of tight wooden temporary bulkhead at least 1 foot off the permanent bulkhead uptakes, or casings with the smooth side facing the stowage of the explosives or ammunition. When permanent bulkhead is smooth on cargo side, commercial 2-inch boarding secured by 4-inch by 6-inch uprights spaced not more than 30 inches apart in tween or shelter deck, or 6- by 6-inch uprights spaced not more than 24 inches apart in lower hold. A 2- by 6-inch bearer to carry the upright will be laid on the metal deck, and a 2- by 6-inch header will be fitted against the underside of the overhead to receive top of uprights. Suitable horizontal stringers will be fitted between temporary and permanent bulkhead at top and bottom, as well as intermediate stringers spaced a maximum of 5 feet apart. When permanent bulkhead stiffeners are on the cargo side, suitable uprights of not less than 2 by 4 inches may be installed against the permanent vertical stiffeners to provide the required 12 inches off the bulkhead. If the permanent stiffeners are over 30 inches apart, center-to-center, 2½-inch boarding will be used.	Deviations not permitted. Minimum of 4- by 4-inch uprights can be used when 4- by 6-inch lumber is unavailable; however, upright spacing must not exceed 24 inches on tween decks or 16 inches in the lower holds. Headers and bearers are optional. 2- by 4-inch spacers are wedged to overhead beams or ship's structures as required. When permanent stiffeners are over 30 inches apart, intermediate wood stiffeners are built at locations between permanent stiffeners so that 30-inch dimension is not exceeded and 2½-inch boarding not required. Proper 12-inch spacing can be achieved by laminating three 4- by 4-inch uprights and a single 2- by 4-inch piece. Boarding shall be 2- by 1- or 2- by 12-inch material.
46CFR146.29-81 (c)	Magazines constructed of wood will have side and end bulkheads of commercial 1-inch lumber, of ¾-inch tongue-and-groove sheathing, or of ¾-inch plywood, secured to uprights of at least a 3- by 4-inch size, spaced not more than 18 inches apart and secured at top, bottom and center with horizontal bracing. When ¾-inch plywood is used, uprights may be spaced on 24-inch centers. A 2- by 4-inch bearer and header will be used for the uprights. Tops of uprights fitted against channel beams may be wedged directly to the beam with 2- by 4-inch spacers fitted between. When a metal stanchion, post, or other obstruction is located within interior area of magazine, it must be completely covered with wood of a thickness of at least ¾ inch secured in place with nails or screws.	2- by 4-inch bearers and headers not mandatory.

**COMPARISON OF APPROVED CONSTRUCTION TECHNIQUES
WITH ALTERNATE METHODS (CONT)**

REGULATION NO.	APPROVED CONSTRUCTION TECHNIQUES AND MINIMUM LUMBER SIZES	ALTERNATE CONSTRUCTION TECHNIQUES FOR OTHER LUMBER SIZES
46CFR146.29-89 (b)	Portable magazine stowage. Portable magazines will be constructed of wood or metal, lined with wood of ¾-inch minimum thickness.	¾-inch minimum in hold. 2-inch minimum on deck when material availability permits.
46CFR146.29-89 (d)	When constructed of wood, the scantlings will not be less than those required for a Type "A" magazine in 46CFR146.29-81, with a closefitting hinged cover or door with an effective means of securing.	3- by 4-inch minimum uprights; 4- by 4-inch preferred when available; spacing requirements unchanged.
46CFR146.29-89 (g)	When stowed on deck, the magazine will be protected from the direct rays of the sun and elements. (Ed. note: i.e., near or beneath a ship's structure as opposed to being completely exposed on deck.) Runners, bearers, or other suitable means will be provided to elevate it a minimum of 4 inches from deck.	Construct in accordance with minimum material specifications outlined for class "A" magazine. Use of 4- by 4-inch uprights preferred when available. Magazine shall be lined with clear or black polyethylene sheets of at least a 4-mil thickness or felt construction paper of at least 15-pound grade. 4- by 4-inch lumber will be used for the bottom runners to achieve the proper elevation from the deck.
46CFR146.29-93 (d)	Stowage of blasting caps, detonators, and primer detonators. When Class VIII ammunition is stowed over tween-deck hatch covers and military explosives are stowed in hold below, a single layer of 2-inch commercial lumber is required over tween-deck hatch cover.	Deviation not permitted.



100

100

100

100

100

100

100



CHAPTER 7 CONTAINERIZED CARGOES

In the late 1950's the shipping industry began to containerize cargo. Simply stated, this means they began to put cargo in metal boxes (containers) that were all the same size. The industry soon found that containerization was cheaper, faster, and more efficient. Containerization caught on. The vast majority of freight ships now are containerships. This has caused some real problems in terminal operations. Some ports are designed to unload containers and others aren't. Since the military is beginning to use containerized cargo, it has become necessary for the terminal operations coordinator to understand how to load and unload containers on and off a ship.

Containers can be loaded not only in the holds of the decks, but on its weather decks. This and other peculiarities of containerized cargo shipment have caused some changes in the shipping industry that must be considered. We'll discuss some of the problems of containerization and their solutions in this chapter. See FM 55-70 and TC 55-5 for more information on container operations.

CONTAINER HANDLING EQUIPMENT

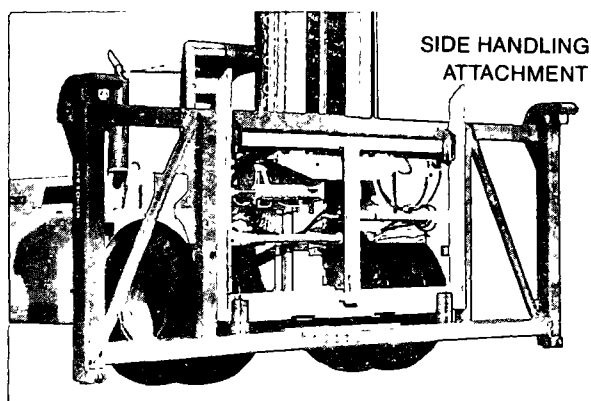
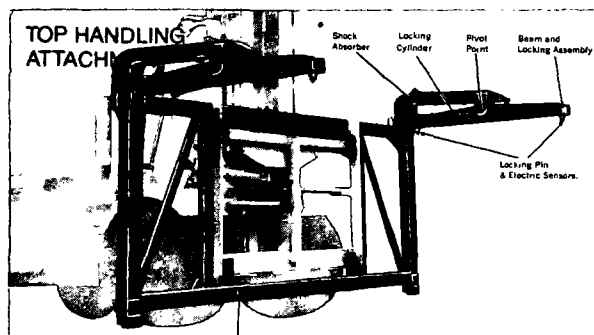
To gain full advantage of containership operations, the container must be moved efficiently, speedily, and safely through the terminal. This is accomplished by using special handling equipment. The type of handling and lifting equipment varies from terminal to terminal. This depends primarily on the container storage method used, the modes serving the terminal,

and the overall layout of the terminal storage area. The design of a new terminal is often determined by the type of handling equipment to be used. (The handling and lifting equipment described here was selected as typical of the many different manufacturers' models available. However, their selection does not indicate Army endorsement.)

FORKLIFT TRUCKS

Forklift trucks are used to handle containers that have fork pockets on the sides. The weight of the container must not exceed the lift capacity of the forklift. Special attachments have been made for use in handling containers with forklifts. One such attachment is used for top handling ANSI standard 8x8x20-foot containers

with a maximum gross weight of 47,500 pounds. There is also a side handling attachment for handling partially loaded or empty containers. Both attachments are easily mounted and dismounted by the operator.



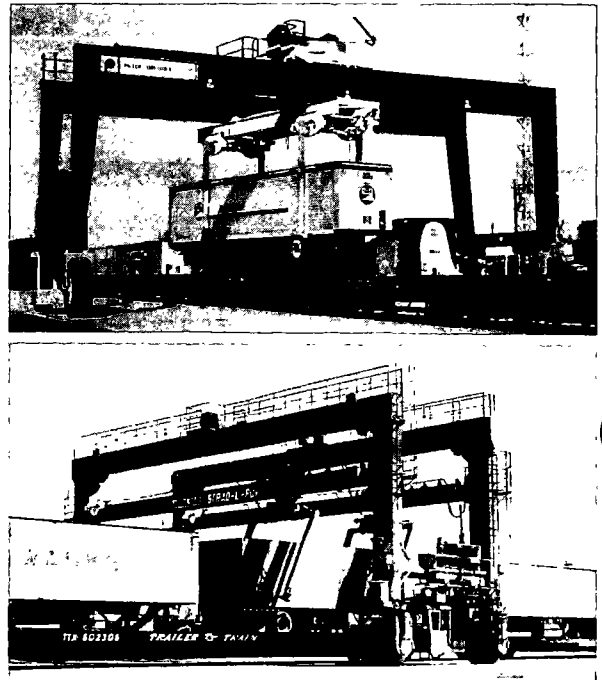
Two other vehicles designed for handling containers are the *front loader* and *side loader*. The front-loading container has a 50,000 pound capacity, and stacks 20-foot containers normally used in a logistics over the shore (LOTS) operation. It can also stack containers up to 40 feet long, two high loaded or three high when empty. The side-loading container has a 67,200 pound

lifting capacity. Requiring a hard fixed surface, it is normally used in a fixed terminal operation. The side loader can stack loaded 20-foot and 40-foot containers two high. Working with 40 foot containers, the side loader requires a minimum working space of 15-foot working aisles and 50-foot intersecting aisles.

STRADDLE CRANES

Straddle cranes are self-propelled gantry cranes. They move on rubber tires or on rails. They may straddle from one to six railroad tracks while loading and unloading containers and piggyback trailers. Both the tire and rail-mounted types are highly versatile. They are capable of lifting up to 50 tons, moving through narrow aisles, and spotting containers in specific locations throughout the storage yard. Many have the capacity for stacking containers two and three high. The lifting device used on the straddle crane is usually a universal lifting spreader. It fits into special lifting slots at the top of the container. The spreader may fit completely underneath the container.

The two straddle cranes shown to the right are both mounted on rubber tires, although some straddle cranes are mounted on rails. Both are shown in a piggy-back operation. Each has a skewing trolley, which permits them to move in a straight line or at an angle.



STRADDLE TRUCKS

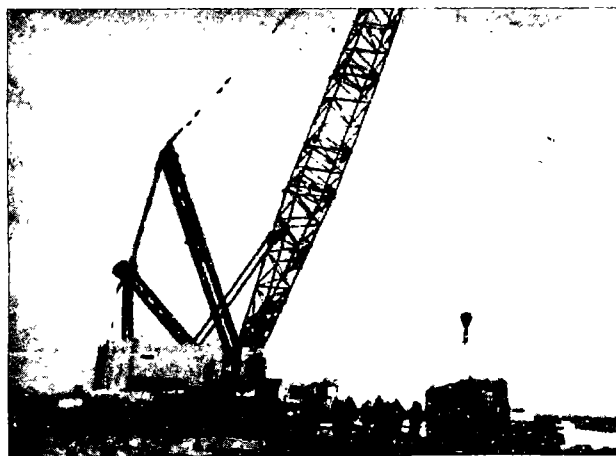
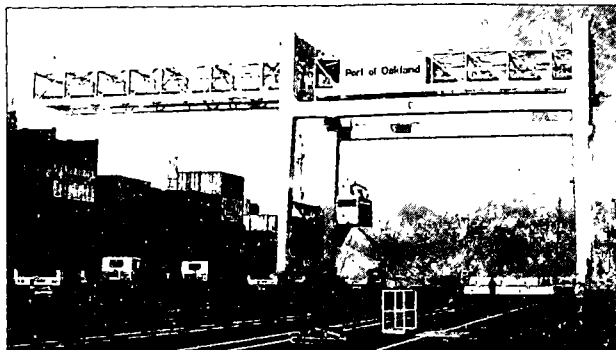
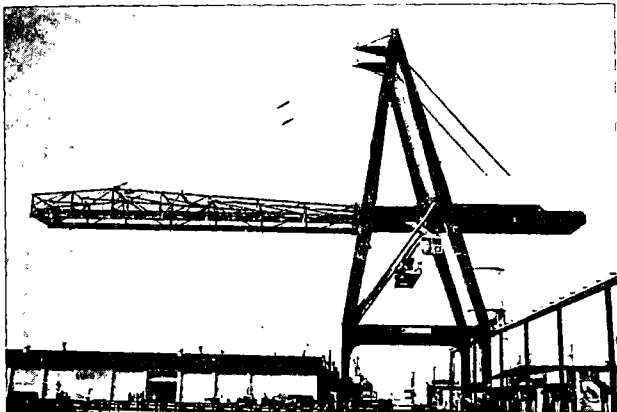
Straddle trucks are similar to straddle cranes. However, they are smaller than a straddle crane and are limited to straddling one container. They pick one container from its stack in the storage area and move it alongside the vessel. However,

the straddle truck has more speed and maneuverability than the straddle crane. It may either lift the container from the top with the universal spreader or from the bottom with lifting arms.

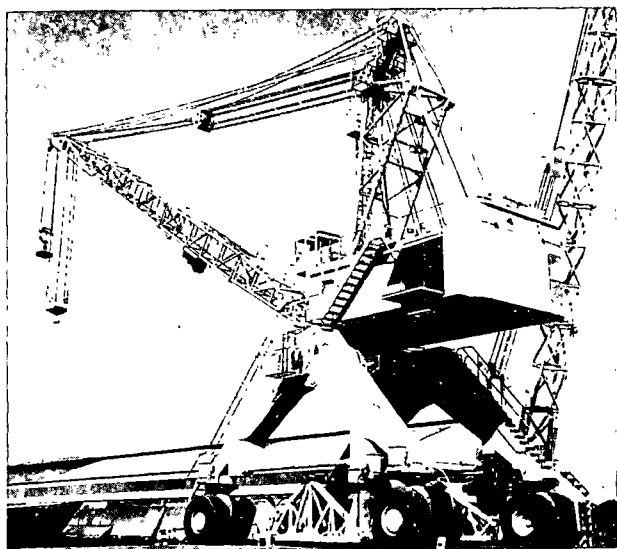
DOCKSIDE CONTAINER CRANES

The dockside cranes for handling containers are designed for quick loading and unloading. This greatly reduces the time a container ship must spend in port. By using these cranes, ship turn-around time has been reduced from 110 to 40 hours in some instances. Container terminals

share restrictive limitations peculiar to each terminal. Therefore, the particular design of dockside cranes depends upon the requirements of the terminal served. Some representative dockside container cranes in use are illustrated on the following page.



Above: A typical dockside 40-ton capacity container crane. This crane is capable of handling containers at the rate of one per minute. *Below:* This mobile gantry crane has four-wheel drive and is mounted on rubber tires. It has an 80,000-pound capacity at its maximum boom radius. *Upper right:* This unusual low profile dockside crane is located at the Port of Oakland in California. *Middle right:* This 300-ton mobile crane handles a 35.5-short-ton lift at a 90-foot boom radius. When positioned on a wharf, it can reach across a container ship and lift a 40-foot container from the outboard container cell or platform. The crane may also be used from a floating platform or a lighter. *Lower right:* This dockside crane is capable of handling two unattached 20-foot containers simultaneously.

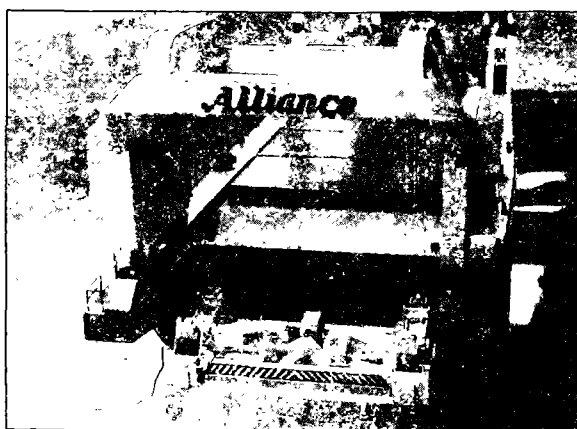


SHIPBOARD CONTAINER CRANES

When ports of discharge do not have pierside cranes of sufficient size and design to discharge nonself-sustaining container ships, a ship-board system must be used. This system has been used by a commercial contractor on its shuttle ships to unload cargo in ports not equipped with pierside container cranes. One disadvantage in using a shipboard crane system is that it limits the size of the deckload the vessel can carry. The crane must be able to travel the length of the load without hitting the top of containers.

Two types of shipboard container crane are shown here. The first is a hinged girder extension design that has a 17-long-ton capacity and a 10-foot load outreach. The offshore boom can be raised to help compensate for the list of the vessel in port. The booms fold down for compact stowage when not in use. Cranes of this type are also being built for the lighter aboard ship (LASH) program.

The second type features a short wheelbase, fold-back girders and a rotating trolley. Here you can see a scale model closeup of a 50-ton crane which will be used on LASH vessels. Unlike the first type, this crane loads and unloads off the ship's stern. This crane can handle fully loaded lighters on and off the ship at an average rate of one every 15 minutes. The crane weighs 475 tons and is operated by one man. It can handle fully loaded lighters in seas as high as 8 feet.



MILITARY AND CIVILIAN WORKFORCE ORGANIZATION

Agreements with commercial contractors may be made for terminal operations personnel from a terminal service company to provide offloading support by performing the tasks described below in certain foreign ports. In such agreements, the contractor's representatives provide briefing and practical training for terminal operations personnel.

The "stevedore gang" is organized as follows.

Shift Foreman — one per shift. Usually the foreman is an E-7 platoon sergeant, who is responsible for all gangs working on a particular

shift. His position is generally on the pier. However, he periodically checks operations of personnel aboard the vessels.

Gang Foreman — one per working gang. Usually this foreman is an E-5 or E-6 sergeant who is responsible for effective overall supervision of a gang working a particular crane. The gang foreman positions himself aboard the vessel with the three dockmen under his control.

Deckman — three per gang. These personnel, of E-3 or E-4 rank, work aboard the vessel under

the boom of a particular crane. Their duties include lashing or unlashings and locking or unlocking containers on a pontoon.

Pierman — three per gang. These personnel, of E-3 or E-4 rank, work under the boom of a particular crane on the pier. Their primary duty is to lock containers to the trailer chassis or to unlock containers from the trailer chassis as the containers are being loaded or unloaded.

Signalman — one per gang. This individual, of E-3 or E-4 rank, is positioned on the pier and works under the boom of a particular crane. He is responsible for giving proper signals to the crane operator to enable him to maneuver the crane spreader bars into position to pick containers off the trailer chassis or to properly position containers from the ship onto the trailer chassis.

Checker — one per gang. This person, of E-3 or E-4 rank, has one of the most responsible positions in the entire operation. Here are some of the checker's duties:

- Controls paperwork (basically a pre-planned listing of containers by number and sequence for loading or offloading).
- Insures that dock personnel and the crane operator know the loading/offloading sequence.
- Informs truck drivers of the locations where containers will be delivered and where containers can be picked up for backloading.
- Maintains accurate records of container numbers, truck chassis numbers, temperature of refrigerated containers, and any discrepancies noted about the containers.

Stop-Go Flagman — one per shift. This person is required only when working a self-sustaining vessel. This individual, of E-3 or E-4 rank, is positioned in a cubicle near the bridge of the vessel and controls a green and red signal light that is observed by each of the two ship crane operators when both ship cranes are working simultaneously. The Stop-Go Flagman makes

sure only one crane is outboard of the vessel at any one time. This is done to prevent the possibility of capsizing the vessel.

A maximum of four gangs can be worked during a particular shift — two per shore crane and two per ship crane. Sometimes operations are planned so that containers can be loaded or unloaded directly from one vessel to the other. This requires a highly coordinated effort, especially when some containers must be delivered to and picked up from the yard during the same operation.

Generally, there are two commercial supervisors working along with the military personnel during an operation. They constantly check all phases of the operations and give timely advice and assistance to the military personnel.

In operations involving military personnel only, the terminal operations coordinator has the following duties in **shore platoons, ship platoons, and cargo checking sections**:

Shore platoon responsibilities include:

- Locking and unlocking containers from cargo chassis as the containers are being loaded/unloaded.
- Handling the tag lines.
- Stowing and stripping containers.
- Properly stuffing cargo to prevent all possible cargo movement.

Ship platoon responsibilities include:

- Removing container lashings and unlocking them from locking devices.
- Giving the proper signals to the crane operator.
- Opening and closing hatches.

Cargo checking section responsibilities include:

- Tallying cargo
- Providing instructions for on/off chassis storage.

SELECTING ITEMS FOR CONTAINER TRANSPORT

The following items are considered priority items that yield the maximum benefits given by container shipments and are considered over other types of cargo for container transport:

- High value cargo; that is, cargo with an average value of \$1 or more per pound of net weight.
- Classified cargo or cargo where concealment is required.
- Mail
- Fragile commodities, such as electronic components, tubes, radios, etc., requiring extra protection.

- Cargo that can easily be stolen, such as liquor and cigarettes.

Generally the following items should not be considered for shipment in containers:

- Bulk cargoes such as coal, grain, and certain construction materials.
- Unitized loads in excess of 4,000 pounds in weight or 7 feet 9 inches in width.
- Explosive and hazardous munitions requiring specific storage and handling as required by US Coast Guard Regulation 108, Rules and Regulations for Military Explosives.

STUFFING CONTAINERS

Container stuffing refers to the process of loading cargo into a container. The objective of any container stuffing operation is to deliver cargo to a consignee in an undamaged condition and in such a way that it can be efficiently and

economically unloaded. Container stuffing requires special attention because the most hazardous part of an overseas shipment is the ocean movement.

STUFFING PROBLEMS

Stuffing containers for ocean movement creates many problems. One particular problem is overstuffing. Overstuffing causes damage to both the container and the cargo. Another serious problem has to do with the proper labeling of dangerous cargo. Some of the problems that may be encountered in oceangoing movements are listed below.

- The elements of weather are more severe,

especially if the container is stowed on deck.

- The vessel may pitch forward with simultaneous rolling from side to side, which places considerable stress and strain on containers.
- The container is handled more frequently than one on a domestic route.

STUFFING CONSIDERATIONS

As a terminal operations coordinator, you will note that to avoid shipping problems, shipping should take into account the following points.

SELECTION

If a ventilated or controlled humidity atmosphere is needed, the container must meet this requirement.

CARGO COMPATIBILITY

Be sure to store cargo together that will make maximum use of container space. However, do not stuff cargo that might contaminate other cargo. For example, household bleach or paint should not be stored with foodstuffs or clothing. If breakage occurred, the bleach or paint would contaminate the food or damage the clothing.

These examples concern what is known as incompatible cargo items.

PACKING

Place heavy items and wet commodities on the bottom with light and dry commodities on top. Do not stuff dangerous cargo with incompatible items already in a container. Make sure the weight distribution is even throughout the container so that the container is properly balanced.

Cargo should be stowed tightly in the container so that shifting will not occur and thus cause heavy items to be thrown through the container walls. If the cargo does not fill the container, block and brace the cargo. Stuff all containers as though they were going to be stowed on deck. This will insure that containers are watertight and capable of standing greater stress and strain than if stowed below deck.

PALLET HEIGHTS

Uniform pallet-load heights must be used to obtain maximum utilization of container cube when palletized loads are placed in containers. Better cargo cube can be obtained by using a pallet-load height of 43 inches instead of the 54-inch pallet load height used in breakbulk vessels. The illustration here shows how better

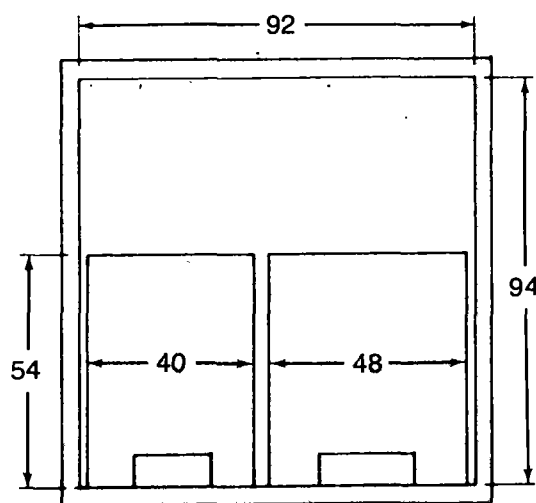
cargo cube can be obtained by using the 43-inch load height rather than using the 54-inch load height.

LABELING AND HANDLING CONTAINERS

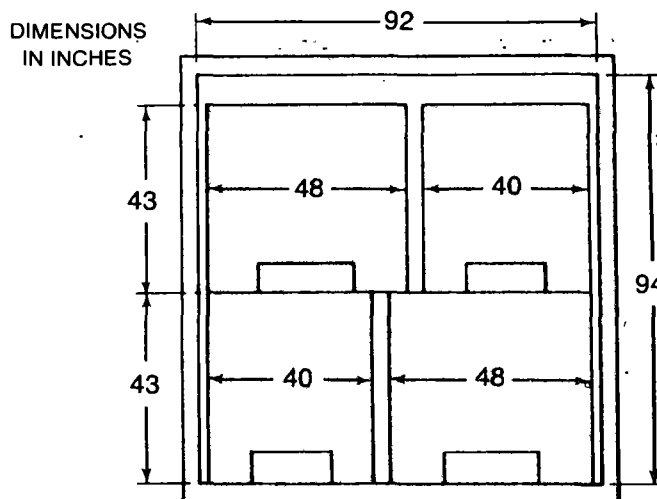
Here are some important points to remember when labeling and handling containers.

The actual weight of each loaded container (payload plus tare weight) must be made available to persons responsible for the physical handling of loaded containers. National and international regulations covering packaging, labeling compatibility, and manifesting of hazardous goods must also be followed when loading and documenting containerized shipments. One label of the type prescribed by the United Nations for individual packages within the container must also be applied to the outside rear of the container, and the shipment date must be shown thereon.

The concentration of weight in any 10 linear feet should not exceed 25,000 pounds or the maximum allowable load, whichever is less. Should this condition occur, the load must be supported on beams of sufficient strength and length to meet these requirements.



UNDERUTILIZED



OPTIMUM LOAD

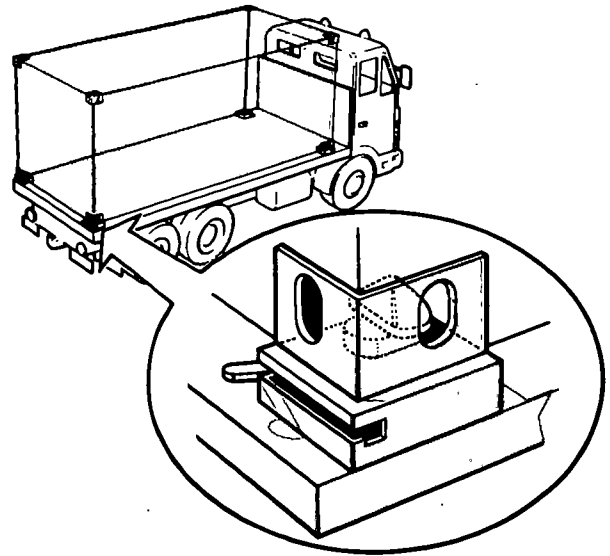
CONTAINER UTILIZATION

SECURING A CONTAINER

After each container has been stuffed, make sure that:

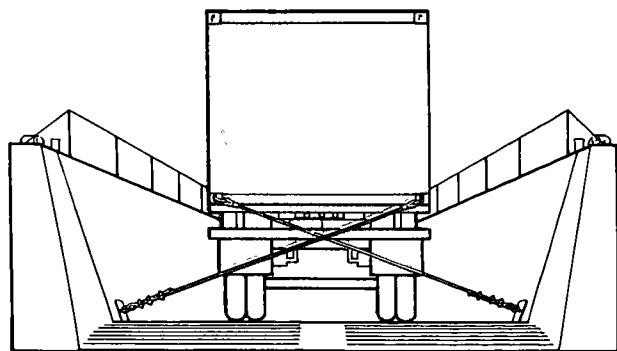
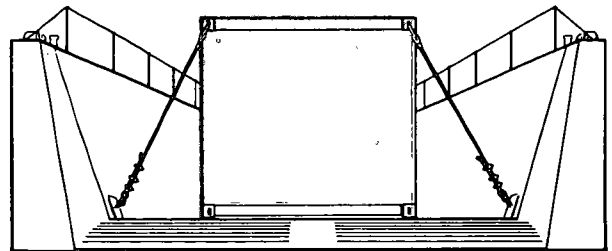
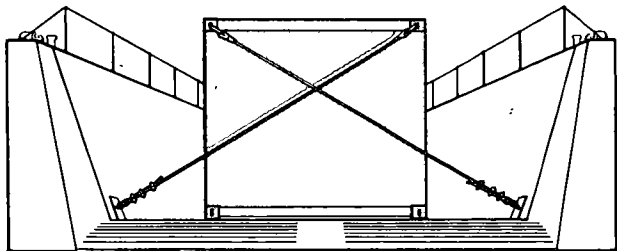
- The doors have been securely closed and are watertight.
- A seal has been placed on the container.
- The seal number has been recorded, the shipping documents and the proper markings have been placed on the container in accordance with Military Standard Transportation and Movement Procedures (MILSTAMP).

Unless other special arrangements are made, twist locks or similar devices should be used to secure all four bottom corner fittings. Shown to the right is an example of a container secured to a truck, and an example of a locking device.

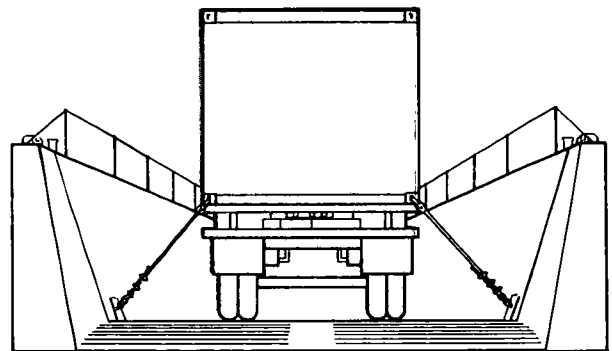


Sometimes lashings are used as a substitute for or in addition to twist locks. This is especially true on the decks of LCU, LCM, or LARCS. The rolling of these vessels can exert severe strains on containers. When lashing is used, it is done from all top corner fittings of the containers if they are sitting on top of dunnage on deck, or it is done from all bottom corner fittings if they are

sitting on MILVAN chassis. In either case, the lashings may or may not be criss-crossed, depending on the deck fittings and/or space available. If not crisscrossed, the lashing should extend off the sides of the chassis and/or container. These techniques provide good protection against upward, side-to-side, forward, and rear movement.



CRISS-CROSSED LASHING



SIDE-TO-SIDE LASHING

LIFTING A CONTAINER

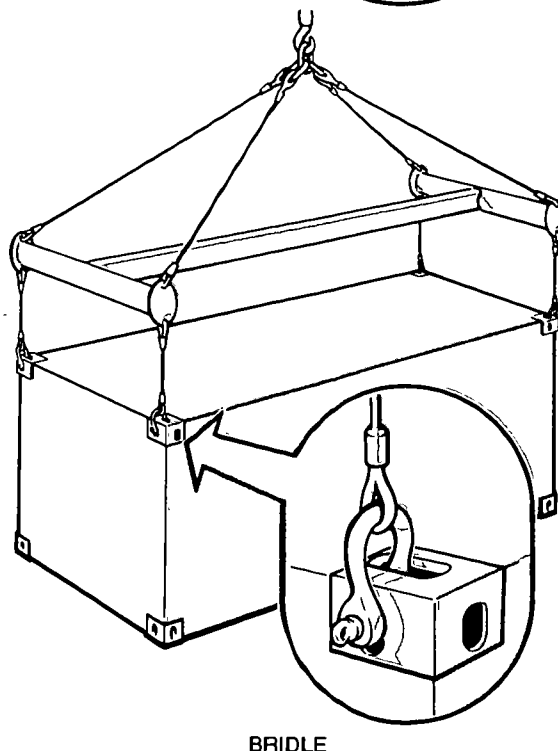
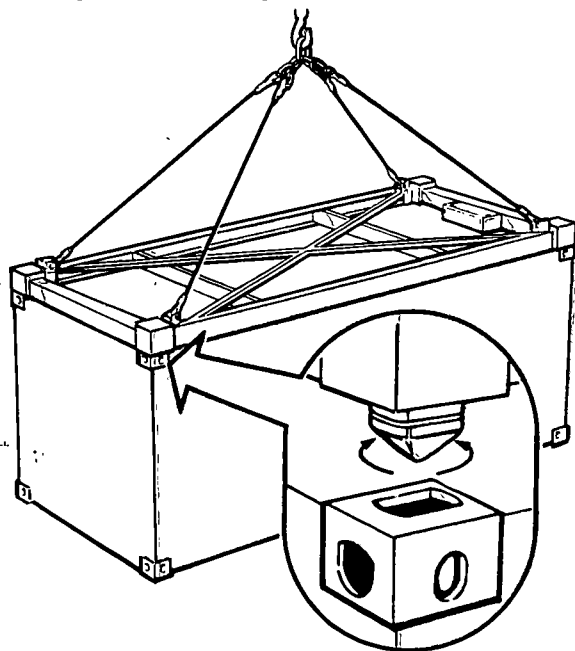
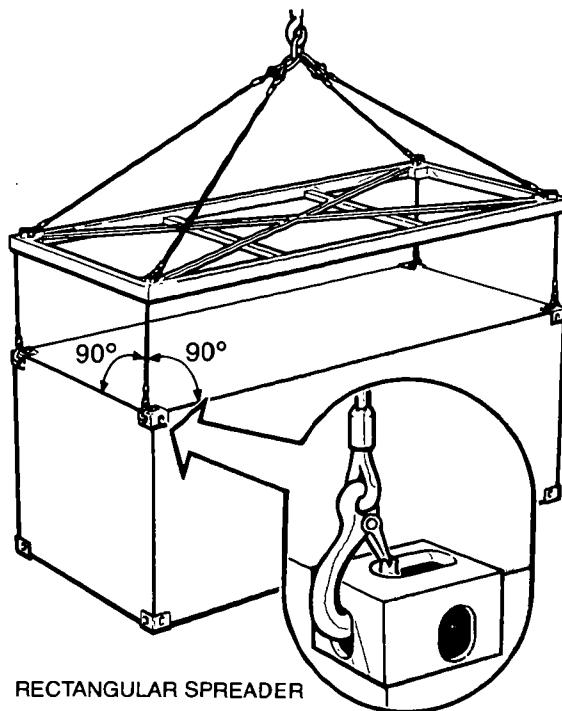
TOP LIFT

Top corner fittings are the recommended lifting points for all types of containers which have them. The equipment should, therefore, be designed for lifting from these fittings and should be properly attached to them.

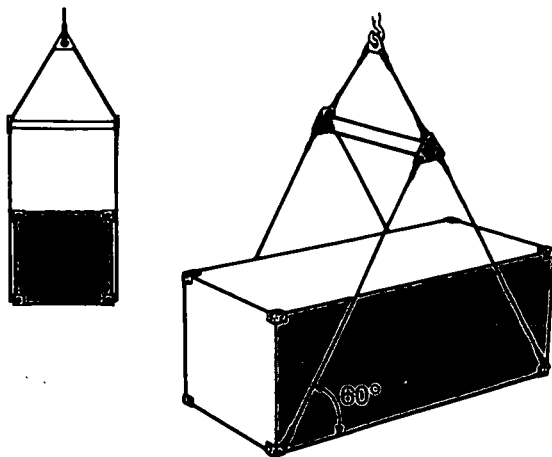
Containers 20 feet or more in length should be lifted only by the following types of equipment.

- Vertical lift, using twist locks.
- Rectangular spreader with pendant hooks or shackles, with the lifting force always applied vertically.
- A bridle arrangement having a long beam the length of the container, with the pendant hooks or shackles which apply a vertical lift to the corner fittings.

Containers are not designed or constructed to withstand forces imposed by lifting while coupled unless four-point engagement is used. For example, all four top corner fittings are used as lifting points. Hooks and shackles used must not damage corner fittings.



BOTTOM CORNER



Containers may be lifted by the bottom corner fittings using hooks or special attaching devices only under two conditions.

The first of these is when sling legs are connected to one or two lateral spreaders (above the roof line of the container) with sufficient width to prevent the sling legs from making contact with the container. Sling legs must be long enough so that the angle of such leg is not less than 60° from the horizontal.

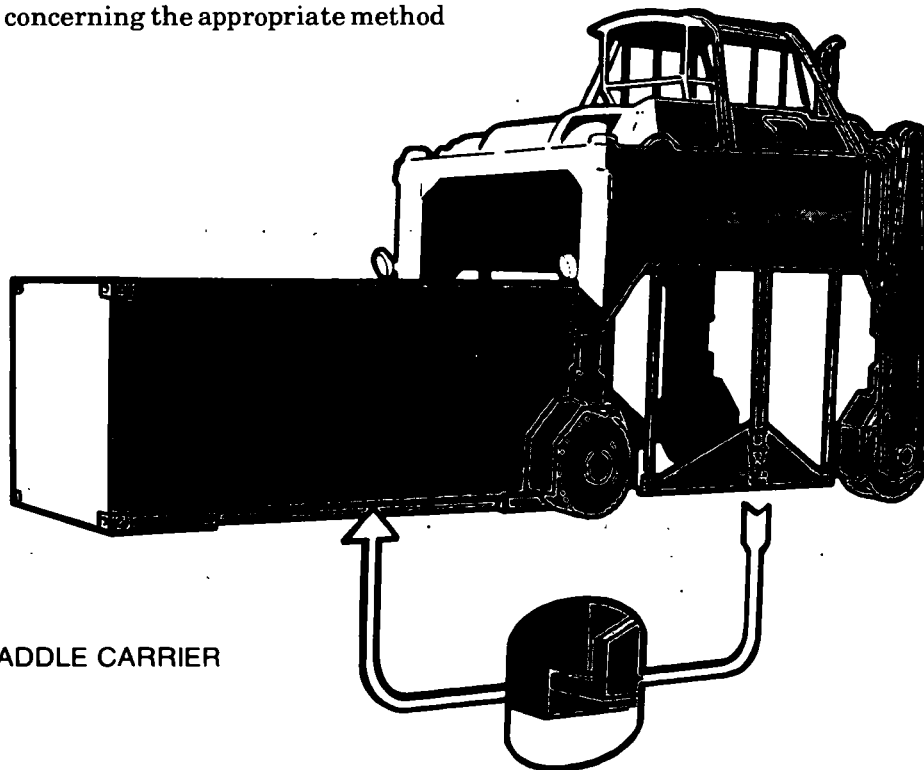
The second condition is when attachment devices are designed so that the lifting force is not exerted more than 1½ inches away from the face of the corner fitting.

OTHER METHODS

Containers that are to be handled by any other method than lifting from the corner fittings will be so designed and fitted with special features, such as forklift pockets, recesses for straddle carriers, or grapple holds. Operators should receive instructions concerning the appropriate method to use.

STRADDLE CARRIERS

When lifting with this device, operators should make sure that the containers are built with recesses. Do not attempt to lift or move a container



STRADDLE CARRIER

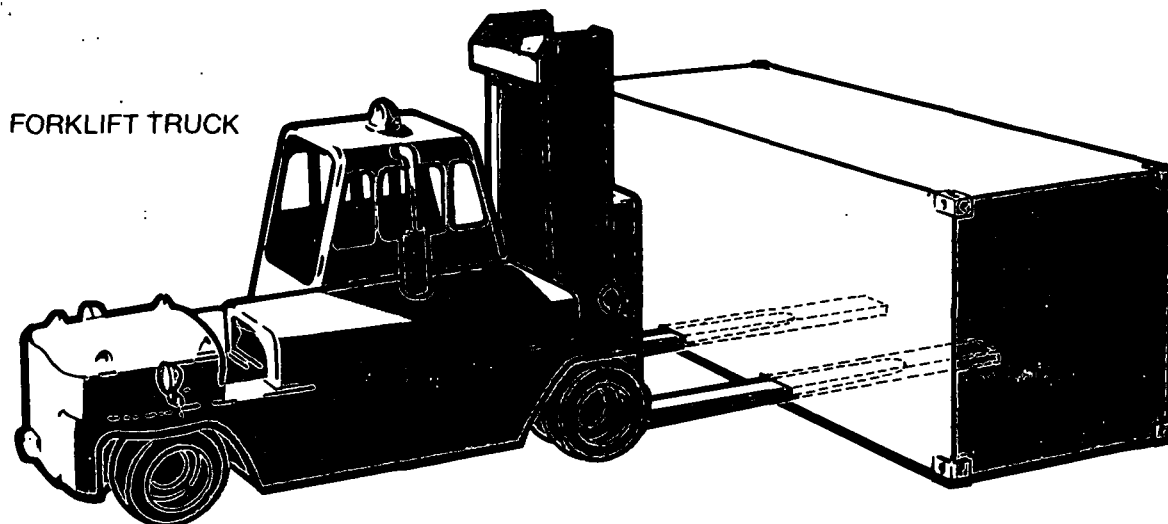
with a straddle carrier unless the container has the appropriate recesses along the bottom.

GRAPPLE LIFT

Proper recesses should be available and used on the lifted containers.

FORKLIFT TRUCK

Forks must extend the whole width of the container. The load capacity of the truck should be enough to handle the container. Never use two forklift trucks, either side by side or one at either end to lift or move a container.



STACKING CONTAINERS

When not in transit, containers are often stacked on piers, in transfer facilities, or in other storage areas. Proper safety precautions are also required here to prevent accidents and damage. When stacking, particular attention must be paid to the proper alignment of top and bottom corner fittings of the containers.

LANDING SURFACE

When putting a container on the ground or pier in a terminal area, a firm flat level surface must be provided so that the container can be supported by its four bottom corner fittings. There must be no projections on the landing surface which could possibly damage the bottom structure of the container.

SUMMARY

As you have seen, containerization has caused many new ways of thinking of cargo loading and unloading. Special equipment is needed for moving containers and loading them aboard. You can put some things in containers, but not others. Further, loading or "stuffing" the container is different from loading a wooden crate. The solutions to the problems are relatively simple if you are familiar with the procedures for handling containers and if you have the proper equipment.

This chapter has covered procedures for loading and unloading containers. The next chapter covers special operations using containers and breakbulk cargo. Both chapters 7 and 8 can help you deal with containers. For further information, however, FM 55-70, Army Transportation Container Operations, contains much more detailed information about containerized cargo operations.



CHAPTER 8 SPECIAL CARGO HANDLING OPERATIONS

The port officer has a problem. A flight of enemy fighter planes penetrated the air defenses and sank two ships at the main piers. To make matters worse, they also sank a freighter at a critical point in the channel and it has effectively blocked the channel. Adding salt to an already painful wound, enemy agents have sabotaged the port's main gantry cranes.

Does this mean the port has to be closed? Several years ago the answer would probably have been yes, but not today. The shipping industry has developed several new systems that can make use of ports even though they are damaged or underdeveloped.

This chapter discusses three of these new systems. Using these systems you can unload your cargo onto the beach and truck it out. This way you can anchor waiting vessels in the stream (at sea) several miles off the coast. By not being clustered in one area, they are more protected against enemy strafing and bombing.

The last two systems can also be used to quickly discharge ships in a fixed port so that they spend the least amount of time in port. This is significant because the less time they spend in port, the less their chances of being attacked by the enemy.

The key to all these systems is quick discharge. That means the Terminal Operations Coordinator must be very familiar with how these systems work so that he can insure a speedy loading and unloading of ships.

LOGISTICS OVER THE SHORE (LOTS) OPERATIONS

A LOTS operation involves the loading and unloading of ships without the benefit of fixed port facilities. This type of operation is carried out in friendly and nondefended territory. It is also carried out in time of war during phases of

theater development in which there is no opposition by the enemy. A LOTS operation can involve both a breakbulk and a containerized operation.

BREAKBULK OPERATIONS

DISCHARGING OPERATIONS

At a LOTS site, breakbulk ships are anchored off-shore. Both sides of the vessel are worked during discharge operations. If all hatches are being worked, lighters receive cargo over both sides of the ship. For example, the cargo from No. 1 hold is discharged over the starboard side and from No. 2 hold over the port side.

In some cases, sea and weather conditions may be such that discharging cargo from a ship at anchor may be impractical. When this situation exists, the ship should be moored bow and stern to avoid swinging to the tide or wind. All lighters

should be moored on the lee side of the vessel to receive cargo.

Follow these general rules when discharging cargo vessels in the stream to lighters.

Work lighters on the lee side of the vessel if possible. Rig spring lines and mooring lines so that the lighters are positioned directly below the ship's outboard booms. The importance of proper mooring cannot be overemphasized, because of the violent movement which passing ships and rough seas can cause.

When possible, make up unitized loads of small items which can be unhooked and left in the

lighter. Attach two or more taglines to each draft of cargo in order to minimize swinging. In rough water, land the draft at the crest of the wave. Then slack off the runner immediately to prevent the draft from being hoisted as the lighter falls in the trough of the wave.

Do not allow personnel to stand in the cargo space when landing drafts in small amphibians or landing craft. Do not drop loads onto a lighter deck. Doing so will invite damage to the cargo and the lighter and cause personnel injuries.

For safe handling, reband damaged palletized cargo before it is loaded aboard. Plug leaky barrels and reverse the ends if possible.

Warn personnel never to stand beneath a draft of cargo or get between the draft of cargo and a bulkhead of other cargo. Warn personnel never to pull a cargo draft into position, as they might slip and fall underneath the draft. Always push the draft into place.

Special attention should be given to the proper loading, blocking, and securing of vehicles to be carried in the lighters. This is the responsibility of the vessel master and must be inspected prior to movement.

EQUIPMENT

Rough terrain cranes and forklifts are required at the shoreline to transfer cargo from landing craft to motor transportation.

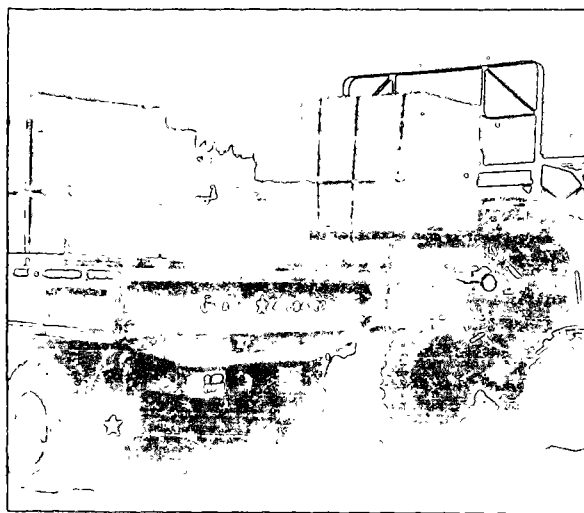
Unless protected from surf action, the sand will be washed from under the wheels of the rough terrain crane, which will tip over when

picking up a lift. There are several things you can do to speed up the operations in the field.

Operate the crane from a floating platform, or make a platform from sandbags or some other material that will hold against the washing action of the surf. Use perforated splashboard on the seaward side of the wheels to break surf action and retain sand under the wheels.

Protect cranes from the corrosive action of salt water. A heavy coating of grease and frequent washing down with fresh water protects against this danger.

Normally with the assistance of a forklift operator, you will have to unload the cargo from the landing craft and load it into a truck. If the cargo cannot be cleared for shipment immediately, it is transferred by truck to a temporary holding area.



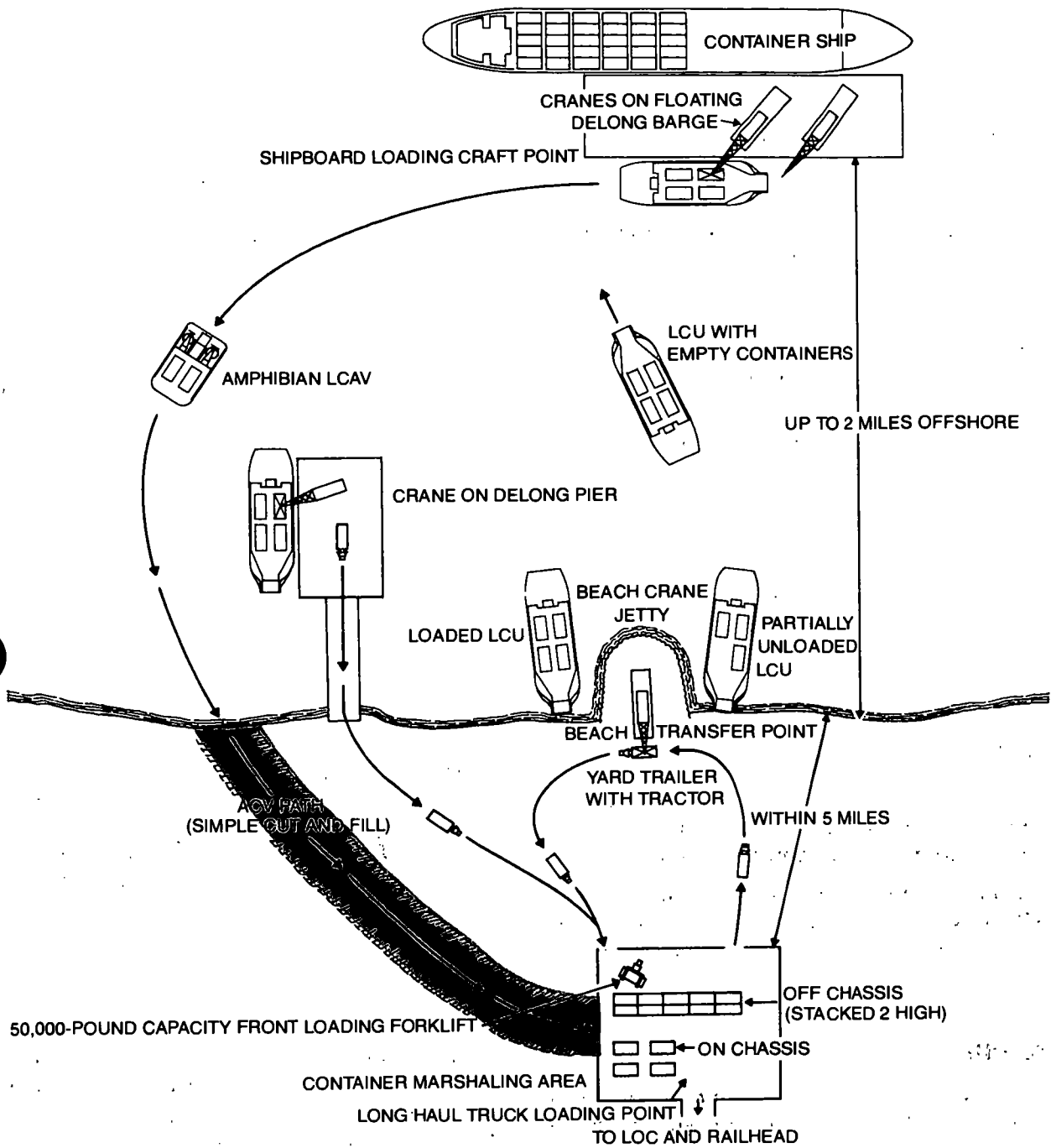
CONTAINERIZED OPERATIONS

DISCHARGING OPERATIONS

Just as with conventional ships, container ships are either self-sustaining (equipped with cargo working gear required to offload their cargo) or nonself-sustaining. The military must depend upon the commercial fleet to deliver its containers to overseas theaters. Self-sustaining ships are preferred in a LOTS operation.

In the case of nonself-sustaining ships, two cranes work the ship anchored offshore. These two cranes are either aboard the ship or on a floating platform alongside.

One crane can handle a 35.5-short-ton lift at a 90-foot boom radius (commonly referred to as a 300-ton crane). When positioned on a wharf, the crane can reach across a container ship and



TYPICAL LOTS OPERATION

extract a 40-foot container from the outboard container cell or (when mounted on a floating platform) onto lighters during stream discharge.

A second crane can handle a 36.5-short-ton lift at a 40-foot radius (commonly referred to as 140-ton crane).

During discharging operations, you should be constantly alerted for new ways to speed up the movement of cargo. For example, where operating conditions are favorable, such as moderate surf, firm beach, etc., empty semitrailers are placed in landing craft. Cargo is then loaded into the semitrailer at shipside. When the landing craft is beached, the semitrailer is towed directly from the landing craft to the depot or to the temporary area. This eliminates a shoreline transfer operation.

When barges are used in the discharge operations, stowage of cargo aboard and movement of the cargo to the hook of fixed or mobile shore-based cranes may present a problem. The use of forklift trucks aboard a barge and a crawler crane alongside on a separate barge has been found useful.

Normally, rough terrain cranes are necessary at the shoreline when cargo must be lifted from landing craft and placed in highway transport equipment.

Pontoon causeways or barges will help in the unloading of motor vehicles. Causeways made of sandbags or other solid material, reaching from the shoreline to the beaching area of large landing craft on shallow beaches, can also be used. These causeways will eliminate the possibility of drowning out because vehicles can roll ashore without passing through the water.

EQUIPMENT

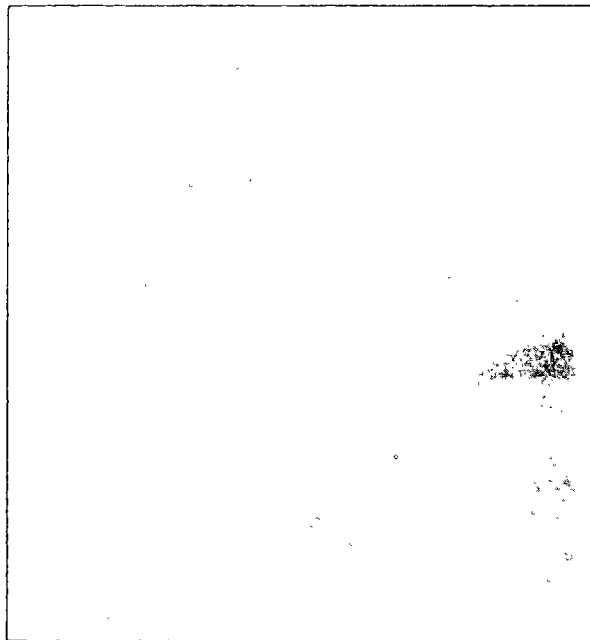
Use of cranes in a LOTS operation requires highly skilled operators, thoroughly familiar with the capabilities and limitations of the equipment. Exceeding crane limits may result in toppling the crane. When a crane is located aboard ship, or on a floating platform, the danger is increased by wind and water action. Pendulum action of a suspended container may easily damage the ship, other equipment, or container contents. Of even greater importance, the situation can be extremely hazardous to personnel.

No matter how skilled he may be, a crane operator requires assistance in the form of signalmen and tagline operators — the number varies

with the situation, but a typical crew might include:

- A signalman in the hold of the ship, to direct the engagement of the containerspreader bar.
- A signalman on deck, on the near side of the ship, visible to the crane operator (when visual signals are used).
- A signalman on the pier, visible to the crane operator, and where the operator can direct the container lowering onto the transporter. (In a LOTS operation, a crew member of the receiving piece of lighterage performs this task).
- A signalman on deck, visible to the crane operator, and to the signalman in the hold.
- Four tagline handlers to align and steady the container as it is lowered onto the transporter.

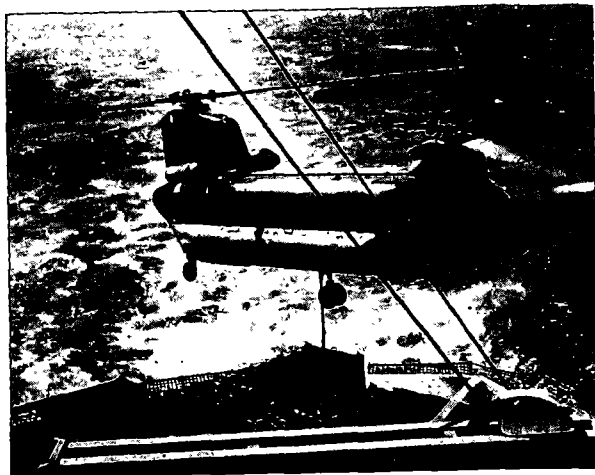
In a LOTS operation, two to four tagline operators may be used at the water's edge. The number used shipside will depend on the method used for unloading and upon the environment (sea state, wind velocity, etc.).



The Army has experimented with several methods for getting cranes to the discharge side for a LOTS operation. One method is to mount a mobile crane aboard a floating pier, with the pier moored to the container ship. Another method is to mount a mobile crane to the deck of the container ship. Another is to place a mobile crane aboard an LST (landing ship, tank) or other auxiliary hull and moor it to the container ship.

The front loading container handler (50,000-pound capacity) is normally used in a LOTS operation. It can stack containers up to 40 feet long (not exceeding 50,000 pounds gross weight). The containers are stacked two high when loaded, or three high when empty.

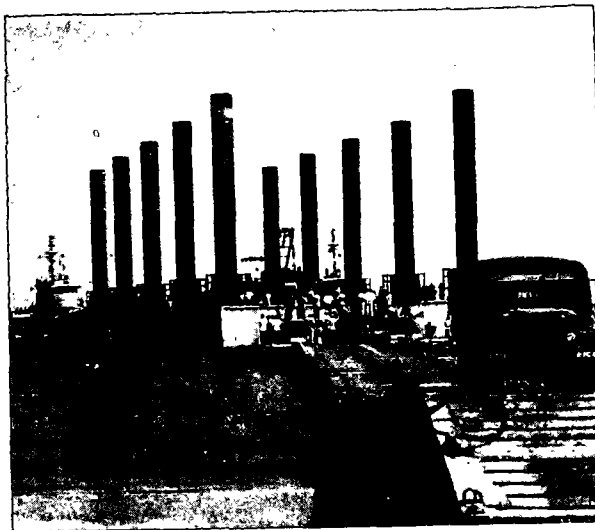
The concept of using helicopters to discharge containers from nonself-sustaining container ships has proven sound. This is especially true when no fixed port facilities are available and conditions are such that it is necessary to use the helicopter lift, or external crane lift.



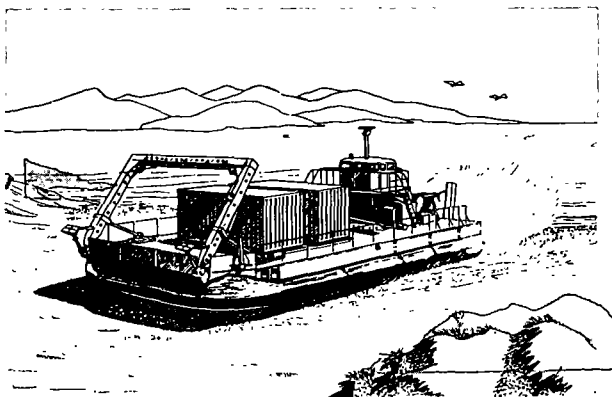
When all cells are emptied, the lifting device is removed by helicopter or external crane. Or it may remain on ship to be used in loading retrograde containers.

The great speed with which this is done, bypassing the beach, is tempered by the high cost of the technique in aircraft, support equipment and skills, and fuel consumption. These factors account for the helicopter's low relative placement above.

The Army requires improved causeway and floatation pier equipment that is readily deployable overseas and that can be rapidly assembled at destination without tools. This type of equipment is particularly required in LOTS operation to promote a more flexible and rapid means of moving containers and vehicles between ship and shore.



The LACV-30 (Lighter Amphibian Air Cushion Vehicle) is intended to replace the LARC-5 and the LARC-15 vehicles by 1980. It will provide a rapid lift capability to move cargo over water, marsh areas, beaches, ice, and snow. It will be capable of carrying containers, wheeled and tracked vehicles, engineer equipment, pallets, nets, barrels, and other general cargo. It will be used primarily in the LOTS mission as a lighter in combat service support operations.



LASH AND SEABEE OPERATIONS

The barge ship system is a new concept in ocean transportation. It consists of a barge carrying ship and a fleet of cargo lighters. Under this concept, the lighters loaded with cargo are discharged from the barge carrying ship. The principal advantage of this system is its ability

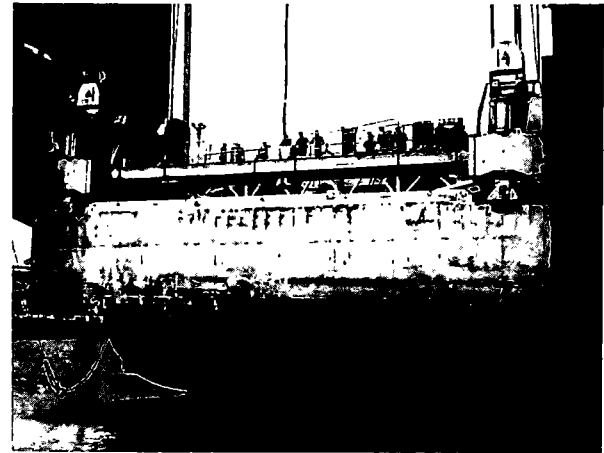
to load and discharge its barges rapidly. This minimizes turn-around time. There are two types of barge ship systems in operation — the lighter aboard ship (LASH) and the sea-barge (SEABEE).

LASH

LASH ships feature a 500-ton gantry crane for loading and unloading the lighters. The lighter crane is designed to traverse the entire length of the main deck with lighters stowed two high on the hatch covers of each hold. The crane runs on heavy-duty rails located directly over the ship's side bulkheads. These bulkheads extend outward at the stern in the form of twin cantilever structures. The crane's lifting frame operates similarly to a container lifting frame. It is self-centering on the lighter's stacking posts. It is equipped with positive latching arrangements to insure a safe lift.

Some LASH ships also carry a self-propelled 35-ton gantry crane for the loading and unloading of containers.

All lighters are approximately 61 feet 6 inches by 31 feet 2 inches by 13 feet deep. LASH lighters are also designed with 36 tiedown fittings along the side walls and end bulkheads. The fittings are rated at 40,000 pounds each. They are useful



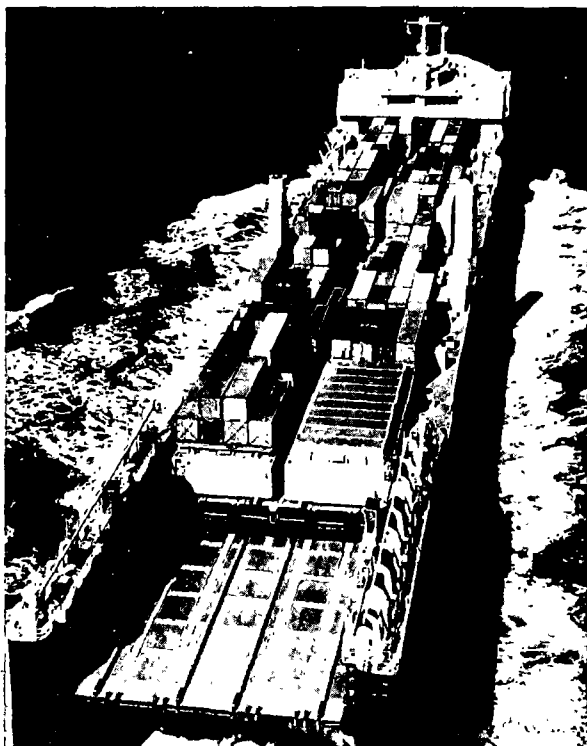
for tomming down loose cylindrical items or securing large loads. Two levels of fittings extend around the entire interior of the lighter. The first level, with five fittings on each side and four on the ends, is 2 feet 6 inches above deck. The second level also has five fittings on each side and four on the ends. It is located 8 feet above the deck.

SEABEE

The SEABEE is arranged differently from the LASH. The ship has three decks upon which the cargo barges or container flats are stowed. Barges are towed to the ship, the ship's stern elevator is lowered, and the barges are floated over the elevator. With the barges seated on its supporting pedestals, the elevator then raises the barge to the appropriate deck. At the desired deck a barge transporter moves on to the elevator and hydraulically jacks the barge up and moves to its stowage position. It is lowered into position and secured. The lower decks are loaded first and discharged last. On the average, a loading cycle

takes up to 40 minutes. Two barges can be lifted with each cycle.

Some container cargoes are stowed on specially designed adapter flats. These are separate from the lighters. These cargoes are then lifted aboard ship by the same shoreside crane used for other container lifts. A barge mounted crane can be used in the stream. The flats, about half the length of a SEABEE barge, are put on the weather deck only. They are supported and secured in the same manner as the barges. Forty-foot, and some 20-foot, containers are stowed aboard these



adapter flats. Thirty-foot containers also can be stowed within the SEABEE barges. In addition, 20- and 40-foot containers can be stowed atop the barges that are stowed on the main deck.

The SEABEE barges are larger than their LASH counterparts. This gives way to more than twice the deadweight and bale cubic capacity for cargo. These barges are general-purpose dry cargo units fitted with lift-off hatch covers. They are of double skin steel construction which greatly decreases the likelihood of cargo damage from flooding or collisions.

PRELOAD OPERATIONS

These follow the same principles of loading that govern any ocean-going vessel. Check the following special points prior to beginning the cargo-loading operations.

On lighters equipped with removable hatch pontoons, only as many covers need be removed as is necessary to load the barge safely. Leaving the remaining covers in place reduces start-up

and cover-up delays. In addition, it provides greater protection from weather conditions. Also, hatch covers left in place make an acceptable location for the precutting or assembly of dunnage.

Remove hatch covers by using a four-leg sling at least 10 feet in length. Covers should always be lifted vertically, since dragging them along a hatch cover will damage the waterproof gasket on the underside. Stack covers on a flat surface to prevent distortion and additional gasket damage.

Lighters arriving with damaged or missing gaskets should be reported to the shipping line, since this will result in the lighter losing its weatherproof seal.

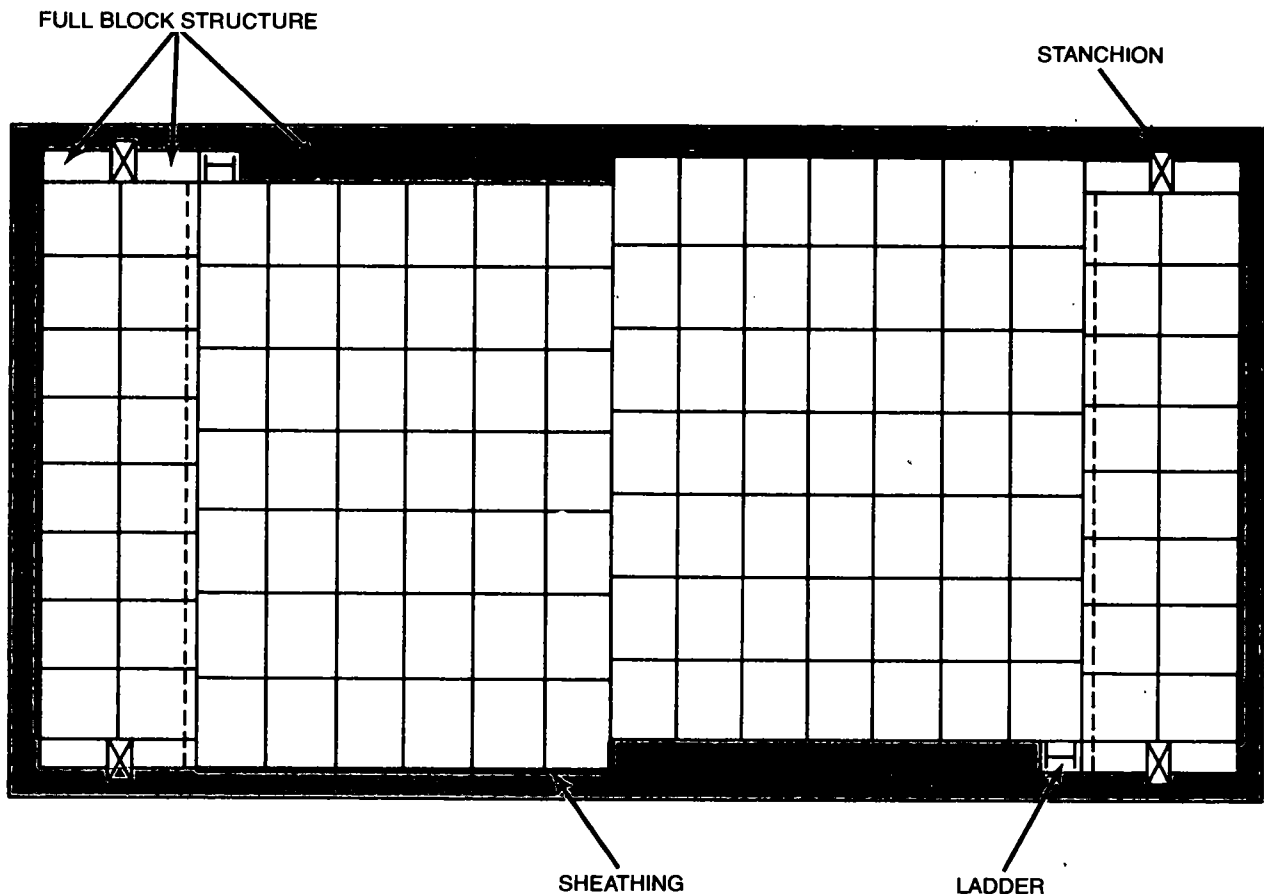
Check the lighters to determine if there is any leakage in the void spaces of the double hull. Any water taken on by the lighter will result in a decrease in the maximum amount of cargo weight that can be stowed. A fully loaded lighter with water in its void spaces could easily exceed the capacity of the ship's gantry crane. To determine accurately if any water is present in the void spaces, take soundings through plugs on opposite corners of the lighter. Take care to keep the sounding plugs tightly in place.

Inspection policies for lighters are identical to those for merchant-type ships. One exception is that each lighter is considered to be a separate compartment. Each must be signed off individually by authorized loading personnel, inspectors, and shipping line representatives.

STOWAGE PLANS

A preliminary stowage plan including the cargo, the load weight, and the dimensions of the individual unit loads is developed for each lighter. In order to use the rectangular stowage area of the lighter efficiently, block stow the cargo. Because of the relatively narrow width of the lighters, maximum space utilization requires rectangular unit loads to be placed in different directions. In each case, the proper positioning of the loads is reflected by the pre-plan.

ITEM CODE	DESCRIPTION	DIMENSIONS
B-562	40-MM CTG	L = 48" W = 40" H = 28"



LIGHTER DIMENSIONS		CARGO	CAPACITY	NOTES:
EXTERIOR	INTERIOR	L	S	
LENGTH - 61'6"	59'9"	WEIGHT - 370	(414)	
WIDTH - 31'2"	29'5"	M		1. 1.23 MS. PER LEVEL
HEIGHT - 13'0"	11'1"	CUBE - 470		2. 3 LEVELS HIGH
				A. TOP (3RD) LEVEL MINUS 38.

In the final stowage plan, the commodity description, number of pieces, tonnage, and port sequence are entered as shown on the following page.

Empty spaces within the cargo stow are caused by cargo sizes that are not even multiples of the lighter's interior dimensions or by the stacking

posts and access ladders that extend into the cargo area. The different ways of shoring these voids determine the types of block stow that may be used in loading lighters.

The types of block stow discussed on the following pages are **block stow**, **staggered block stow**, and **modified block stow**.

FINAL STOW PLAN

BARGE NUMBER _____ **LOADING PORT** _____
PORT OF DISC _____
PORT CODE _____

TONNAGE TOTALS:

[REDACTED]			
XA	V430	XR-2	XA

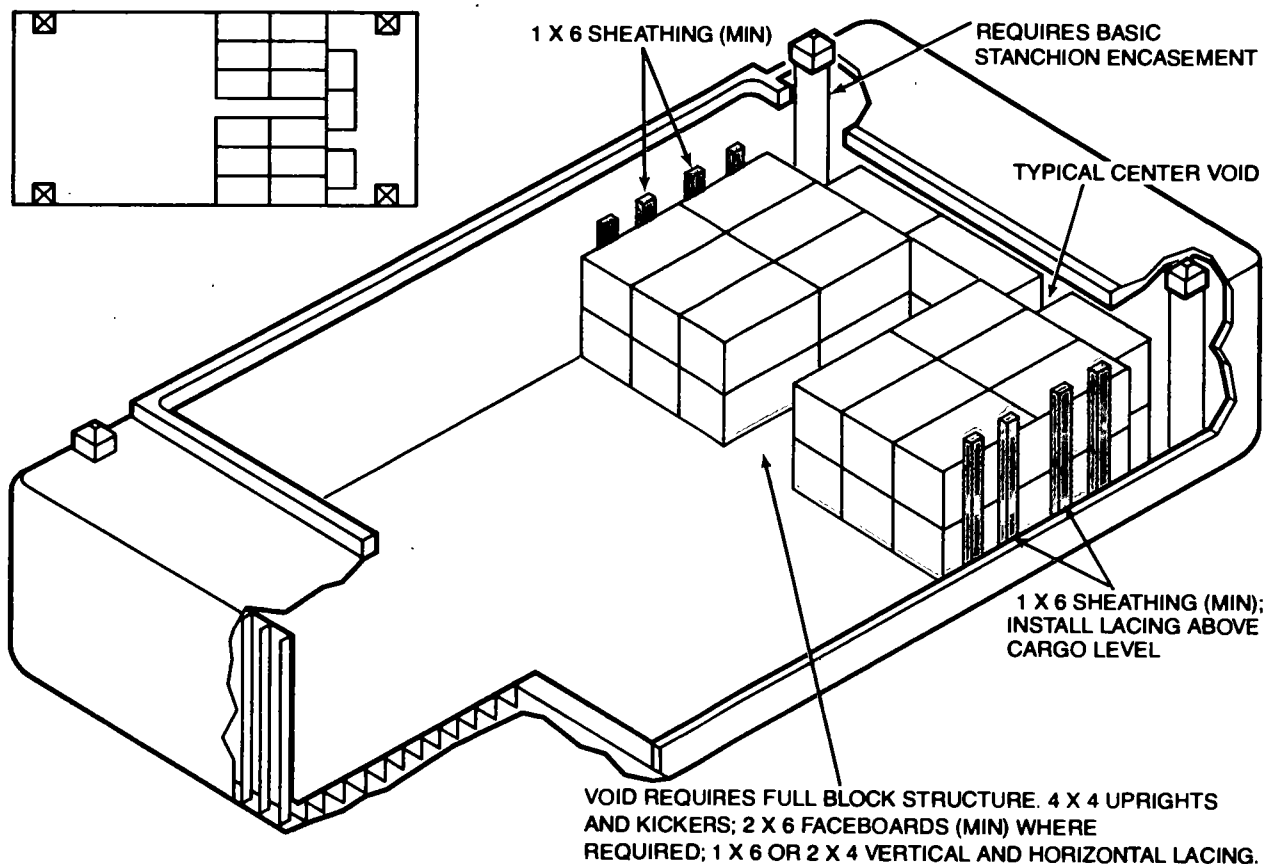
USCG CLASS	→	XA-54 CNTRS
ITEM	→	W'HD SECT GM
ITEM CODE	→	V430
PORT CODE	→	XR-2
TONNAGE	→	81 S/T - 73 L/T - 259 M/T

UNIT	QUANTITY	S/T	M/T	USCG CLASS

BLOCK STOW

Before the erection of encasement structures and the installation of sheathing material, begin block stowage at both ends of the barge. Stow the cargo alternately against each side, and continue to load by moving towards the center line.

Empty spaces should be along both the athwartship and the longitudinal center line. For all practical purposes, the lighters are considered an amidship 'tween-deck compartment. Shown here is the development of a block stow in a LASH lighter.



BLOCK STOW

STAGGERED BLOCK STOW

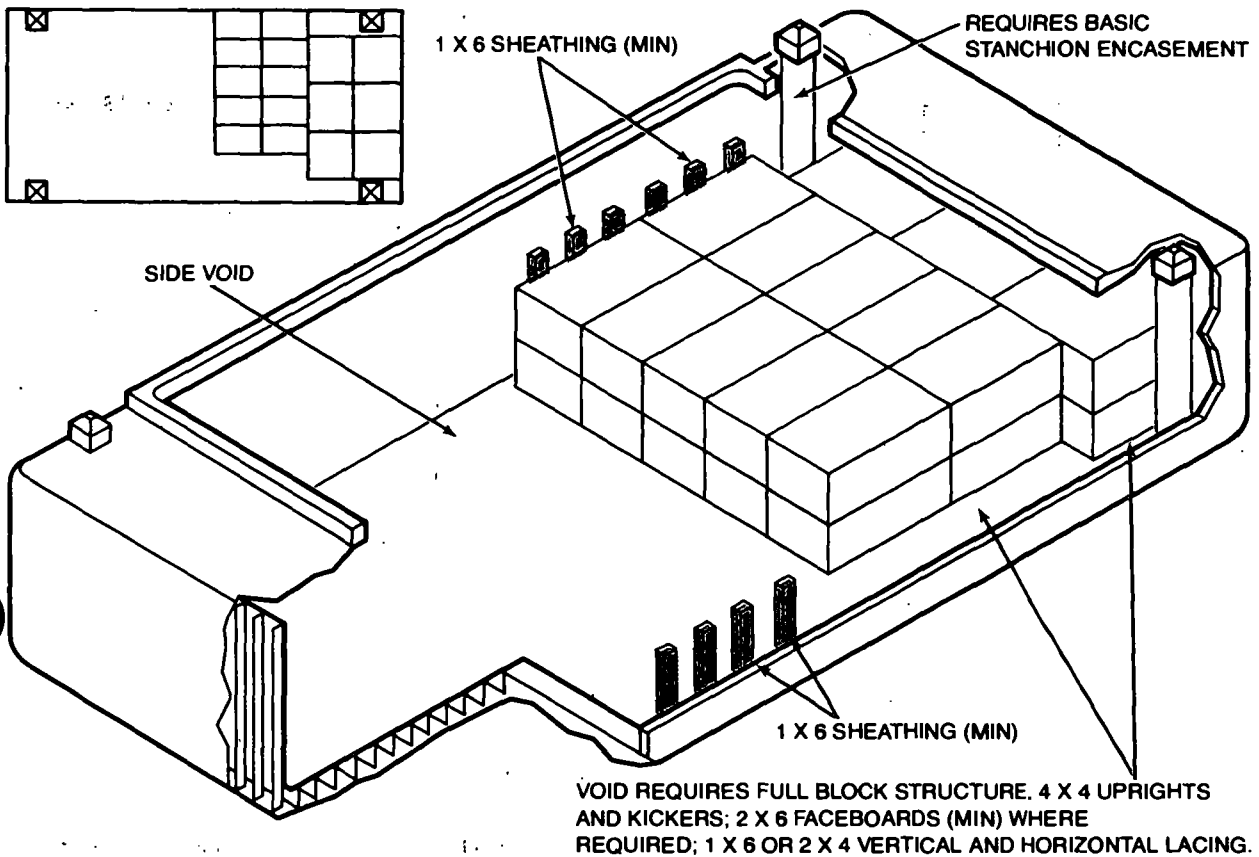
This variation of the conventional block-stow pattern calls for cargo to be stowed tightly against the diagonally opposite side bulkheads of the lighter. Start the stow at each end of the lighter. Stow the cargo in a tight pattern across the lighter until the last load is fitted into place. The empty space that remains between the completed stow and the hull of the lighter is shored with a full-block structure. It is similar to the one constructed on the lengthwise center line in

the conventional block-stow technique. Stow by moving back toward the athwartship center line. The remaining empty spaces are shored with full-block structures.

The principles of the staggered block-stow pattern are shown here. Offsetting the loads in opposite directions around the long center line allows the lighter to remain balanced. Staggered block-stow allows for easy operation of the fork-lift truck in the square of the hatch. This is because these stowage operations take place in

opposite corners of the lighter. Sheathing and encasement structures are required only on one side and at the ends of the barge. In addition, the smooth steel construction of the lighter's side bulkhead allows for block structure of cargo.

This is especially true if the cargo stow consists of mixed commodities of varying dimensions. Shown here is a typical shoring structure installed at the hull when using the staggered block-stowage technique.



STAGGERED BLOCK STOW

MODIFIED BLOCK STOW

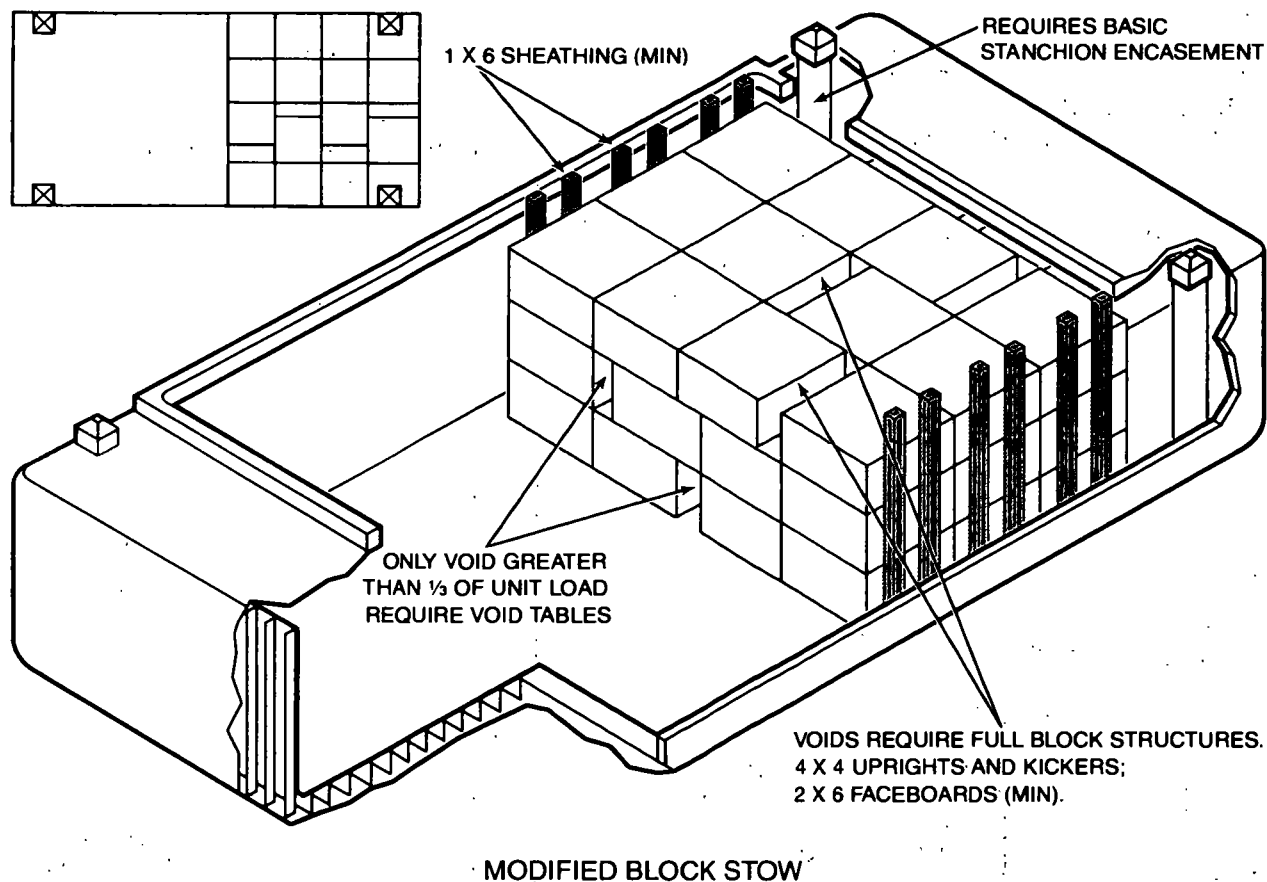
When the hull angles are almost straight up and down, over-stowed unit loads are no longer offset and the sweatboard-to-sweatboard technique resembles block stowage. However, since the empty spaces in the center of the stow can still be shored in accordance with the sweatboard-to-sweatboard technique, another stowage technique that is used is referred to as "modified" block stowage pattern.

As with conventional block stow, stowage operations begin at both ends of the barge with

cargo being placed tight against sheathing and basic encasement structures. Stagger the voids (empty spaces) that occur in the center of the stow between tiers so that they do not occur directly over each other. Voids in the lower tiers less than one-third the width of a unit load do not require shoring. Large voids require vertical support, and a void table is used. Only voids in the top tier require full block structures. Detailed void-shoring techniques are discussed in TM 55-607, Chapter 8. Unlike the conventional sweatboard-to-sweatboard stowage technique, tier stripping is not normally required. This is

because palletized unit loads are not offset and voids never occur under two unit loads. Skidded unit loads of items palletized on metal adapters require tier stripping for adequate support. The

modified block-stowage pattern eliminates the need for large full-block structures. Only basic encasement shoring, void tables, and top tier block structures are required.



STOWAGE ARRANGEMENTS

When stowing cargo in lighters, the barges are stowed aboard the ship in the athwartship direction. Thus, cargo placed fore and aft with respect to the lighter is actually positioned athwart-

ships with respect to the mothership. Overhanging unit loads which are stowed both in the fore-and-aft direction and athwartships within a lighter should be positioned with their greatest bearing surface against the sheathing.

BLOCKING AND BRACING ABOARD LIGHTERS

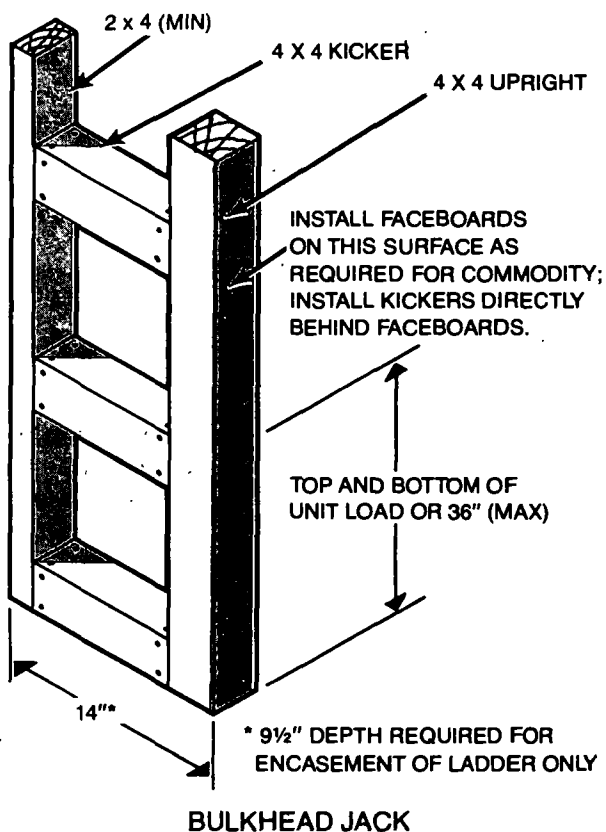
Since lighters are an individual dry cargo hold, the general blocking and bracing techniques presented earlier in this section apply. Unlike a breakbulk freighter, the basic interior dimensions of a lighter do not vary significantly for

different designs. Consequently, many dunnage structures are prepared in advance of the actual loadout operation. Here are some procedures for blocking and bracing structures unique to just lighter loading.

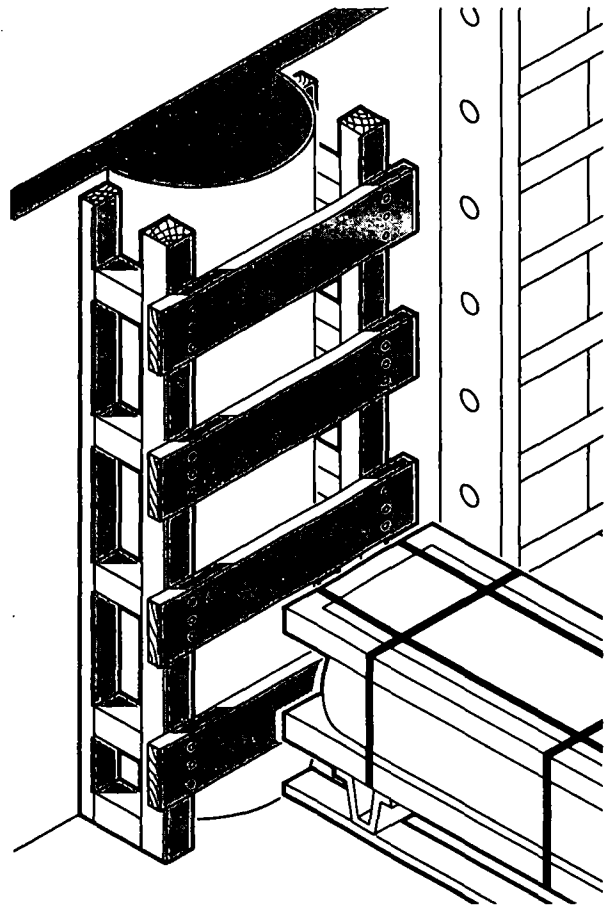
SHEATHING

Sheathing is required between the cargo and the smooth steel sides of lighter. This is because of the moisture condensation on the inner bulkheads. Since this material will normally be in compression between the cargo and the smooth steel sides of the barge, use only 1- by 6- or 2- by 4-inch material above the cargo. Two- by four-inch or heavier material may be used if necessary due to material availability, as long as space permits. The use of reclaimed lumber is also acceptable for sheathing. However, the lumber must be inspected to insure that all nails have been removed. In situations where empty spaces occur at the hull of the barge and full block structures must be constructed, sheathing should be at least 2- by 4-inch lumber in order to receive nails from the kickers.

ENCASEMENTS



The four stacking posts and two access ladders found in lighters must be encased to provide a firm bearing surface for the stowage of cargo. Whenever cargo is to be stowed tightly against these obstructions, basic bulkhead jacks are constructed. Since the sizes and location of each of these obstructions is known, the shoring structures will not vary in size and can be made in advance. Here you can see the construction details for encasement of a stacking post, which protrudes approximately 14 inches into the lighter hold. Space these jacks on either side of

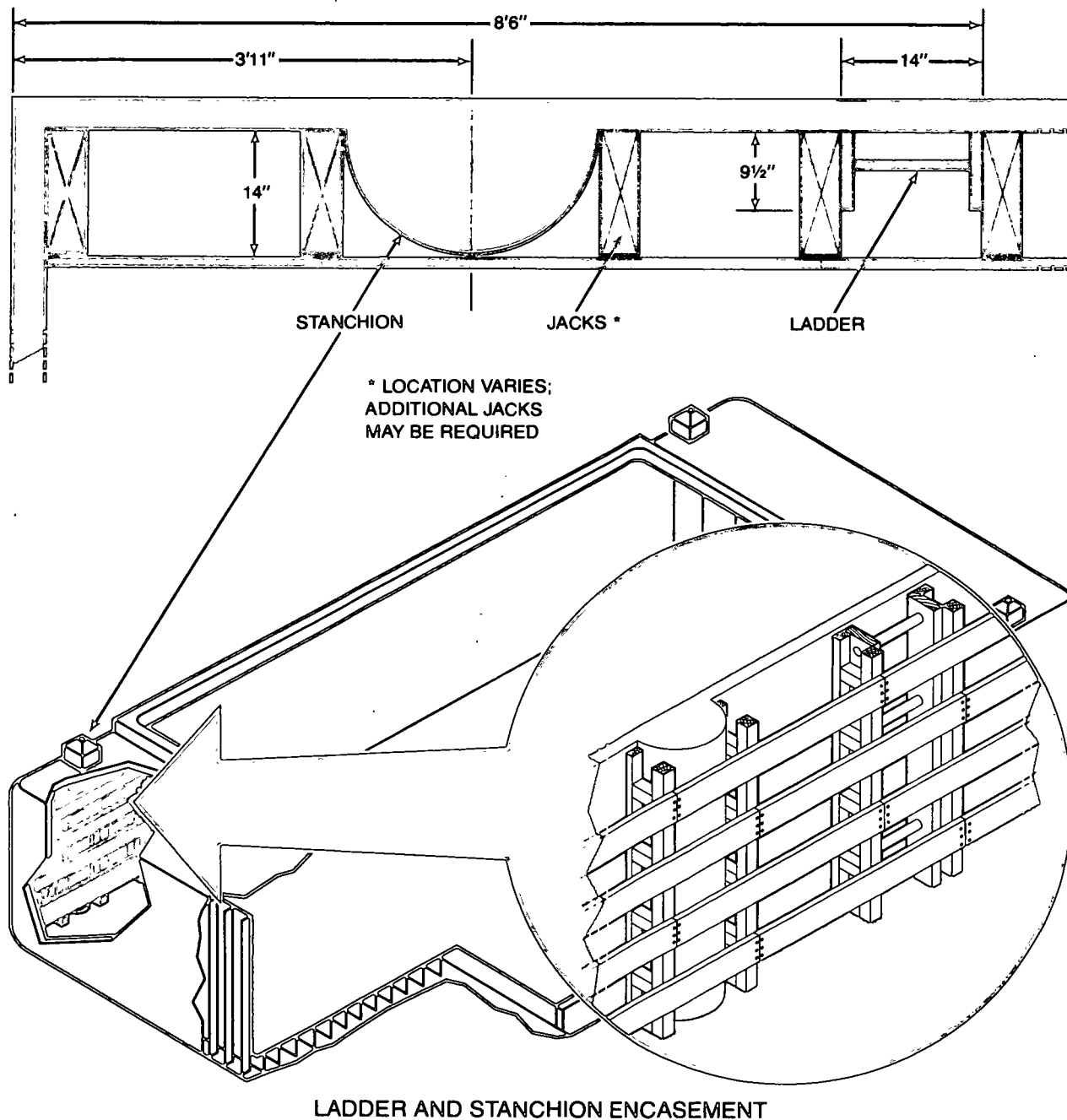


STANCHION ENCASEMENT

the stacking post. Board the face with 2- by 6-inch minimum boarding. Space them equally with the top and bottom of the unit loads to be stowed against them.

The encasement structure should extend out an even number of rows of cargo. On the sides of the barge containing the access ladders, the structure is extended out to include the ladder, which extends approximately 9½ inches into the compartment. Normally, the encasement structure would be extended flush over the ladder.

However, where stowage space is at a premium, the encasement structure is "cut back" after the stacking post, utilizing 9½-inch jacks on either side of the ladder. In any case, never secure cargo so that its weight will be borne by the access ladder. This is because the ladder is relatively weak.

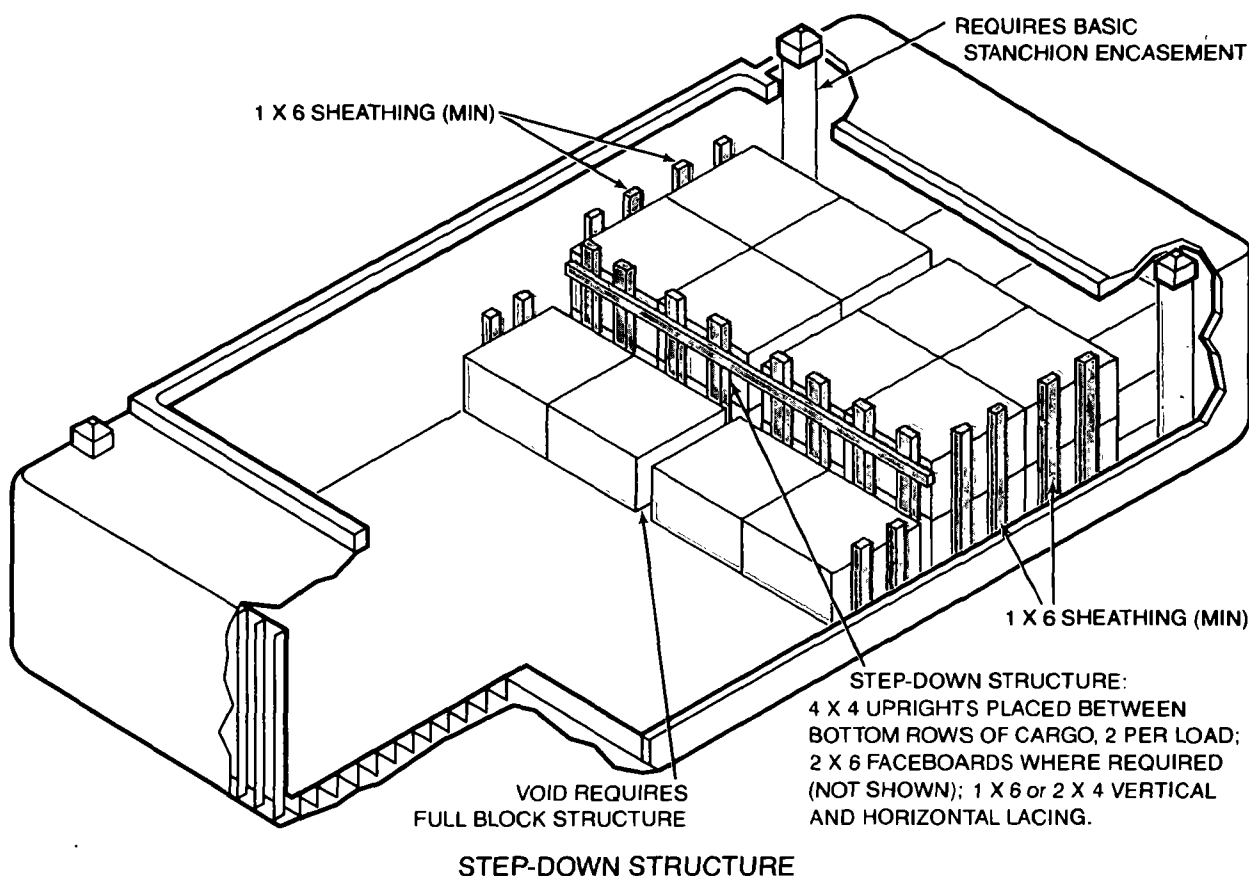


PARTIAL STOW BULKHEADS

Normally, it is better to stow cargo in lighters in full layers to minimize time-consuming securing of the partial top layer. For many shipments, however, maximum space utilization requires the stowage of a partial top layer. In these situations, securing of the partial top layer is accomplished by either a **step-down structure** or a **diagonally braced bulkhead**.

A **step-down structure**, described in Chapter 6 of TM 55-607, is the simplest way to secure a partial top layer. Stow cargo the required number of tiers high to a point shown on the preplan. At this point, two 4- by 4-inch uprights are placed

against each stack of unit loads, and laced from behind with 1- by 6- or 2- by 6-inch material. Install face boards prior to placement of the upright, when required (usually for overhanging unit loads). Resume cargo stowage on the other side of the structure at a reduced height. Step-down structures are not to be used when stepping down cargo more than one tier. Also, do not use them when the cargo on the lower side of the structure is of a lighter weight than the higher stowed cargo. Instead, install a diagonally braced bulkhead as described below. In addition, a step-down structure requires approximately 4 inches of space in the stow for insertion of uprights whenever it is used.

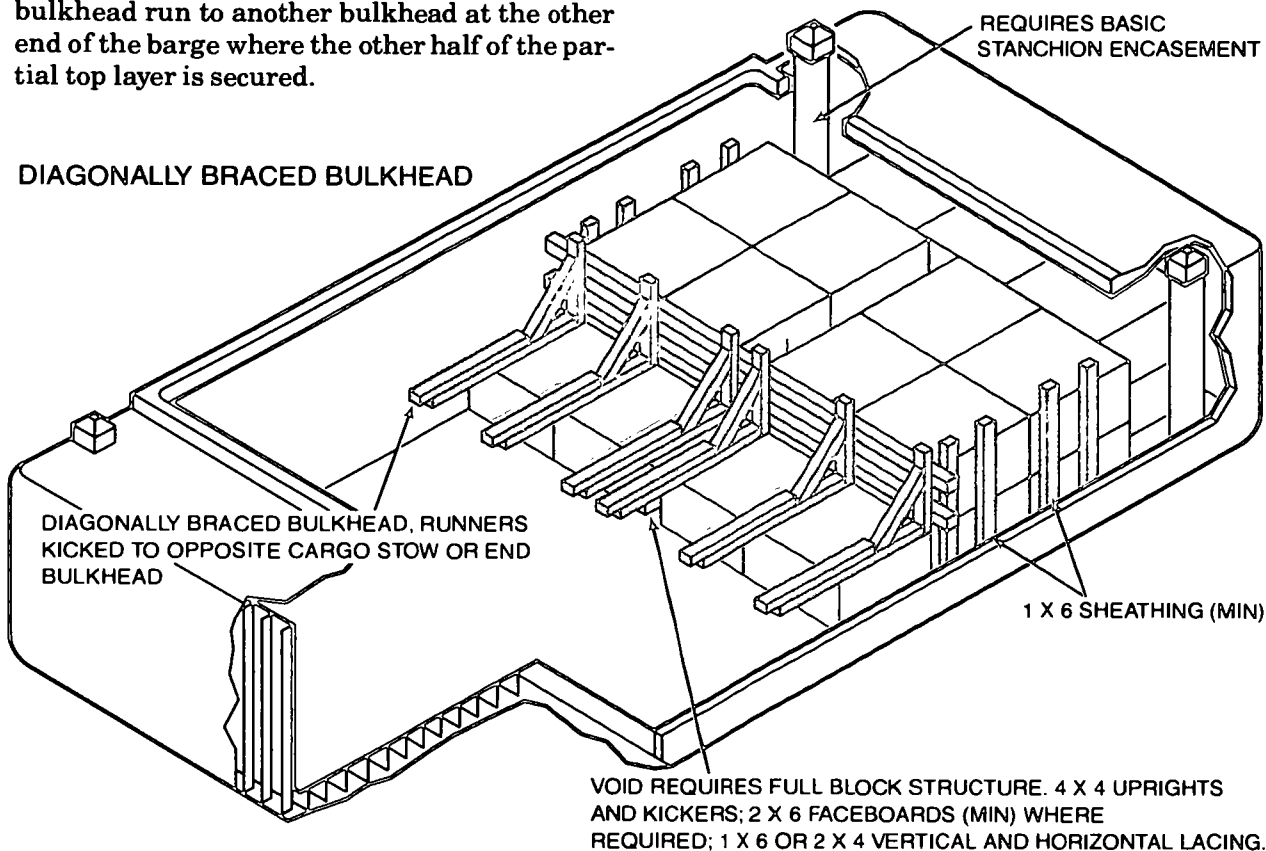


A **diagonally braced bulkhead**, in addition to providing great strength, is used to secure a partial top layer in a lighter. This is especially useful where a tight stow does not permit the in-

sertion of uprights between rows of unit loads, as required for a step-down structure. Here are the construction details of this bulkhead and its usage in lighters. Note that the runners of the

bulkhead run to another bulkhead at the other end of the barge where the other half of the partial top layer is secured.

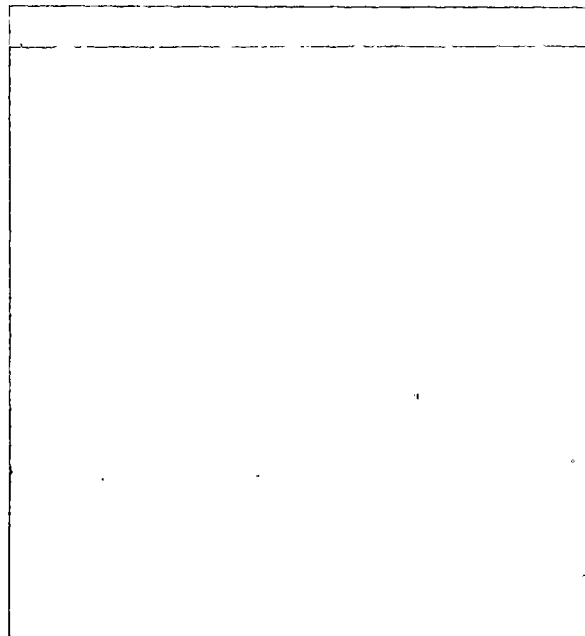
DIAGONALLY BRACED BULKHEAD

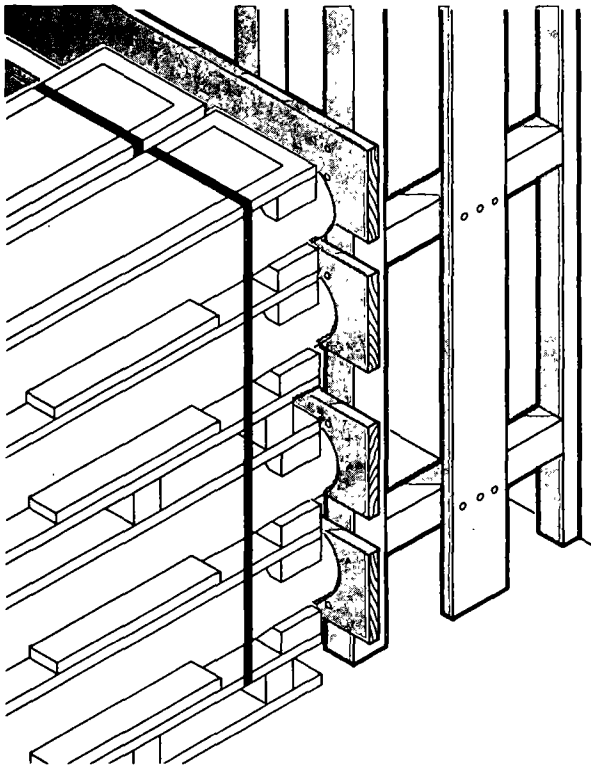


DIVISION OR PARTITION BULKHEADS

These are used in lighters whenever the items are needed to be separated because of compatibility and cargo configuration. Here you can see the construction of a division bulkhead in a LASH lighter. For compatibility purposes, present Coast Guard policy considers a LASH lighter's equivalent to be a compartment on a merchant ship.

Voids occurring within the cargo stow should be shored in accordance with block-stow void shoring techniques. Normally, position two 4- by 4-inch uprights against each stack of unit loads on the sides of the void. Kick the uprights against each other, using 4- by 4-inch lumber, and lace together with 1- by 6- or 2- by 4-inch material. If the staggered block-stow pattern is used, the void will occur along the side of the barge. Use 2- by 4-inch uprights on the side of the full-block





structure against the steel hull. In the event that the modified block-stow pattern is used, top tier

voids are shored with the full-block structures. The face boards are used to resist forces in opposite direction of the kickers. They must be cut to the exact width of the unit loads. Void tables are constructed where needed for lower tier voids. The height and width of the tables should match that of the adjacent unit loads. Both the full-block structure face board assemblies and the void tables are made in advance for specific unit loads.

TOMMING

The tomming of loose cylindrical, light, or shock-sensitive items aboard a barge is difficult to do because of the absence of overhead structures. The A-frame tomming structures are used at the fore-and-aft areas of the barges, since the small deck area provides limited overhead structure. For cargo that is stowed in the square of the hatch and approaches the hatch covers in height, use tomming. In other situations, the use of wire-rope tiedowns and turnbuckles is recommended. The recessed tiedown fittings located along the hull of the barge are used for hook-in points. Use dunnage over the cargo to prevent chafing.

ROLL-ON/ROLL-OFF OPERATIONS

Roll-on roll-off (RORO) describes the system in which fully loaded vehicles are driven onto a specially designed vessel, parked in the ship's hold for the sea voyage, and then driven ashore at the overseas destination. The vehicles are then moved by highway to their final destination. Tractors and semitrailers are shipped as a single unit, or only the semitrailers/containers are

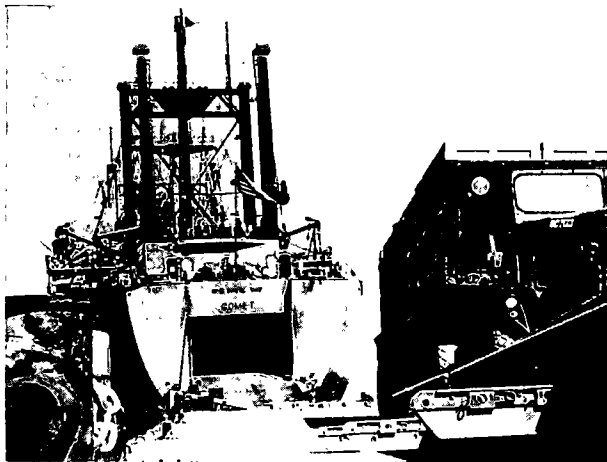
loaded aboard ship and the tractors meet the vessel at the port of debarkation. The tractors help in the discharging of semitrailers/containers.

This RORO system is the most desirable means of transporting vehicles overseas. The military has particular interest in the deployment phase of Army operations consisting of wheeled and tracked vehicles and equipment.

TYPES AND USES OF RORO VESSELS

At present, the Military Sealift Command has four RORO ships under its operational control: The USNS *Comet*, USNS *Meteor*, GTS *Wm. M. Callaghan*, and the SSL *Lurline*. The USNS *Comet* and USNS *Meteor* are part of the nucleus fleet. The GTS *Wm. M. Callaghan* and SS *Lurline* are under charter. These four ships are specifically made to carry both wheeled and tracked vehicles.

The vehicles are rapidly loaded and unloaded under their own power to and from piers or light-erage. The fastest method of loading and discharging of vehicles from the RORO vessel is from either a fixed or a floating pier. If discharging in the stream or a LOTS operation is required, it is accomplished by using vessels such as the BDL LTC *John D. Page*. Although it can



USNS COMET



USNS COMET AND BDL LTC JOHN D. PAGE

be done, it is not practical to use smaller lighterage or nonpropelled barges. For easy movement and stowage aboard the vessel, there are two large vehicle holds, plus smaller cargo holds forward. The two larger holds are separated by the ship's engine room. The holds are interconnected by fixed ramps above and through the machinery space. All decks, including the weather deck, are loaded from the side and stern ports. From there, the vehicles move to the various decks within the ship by means of ramps which constitute normal roadways. Everything is rolled aboard and parked. The vehicles are then secured in the vessel using peck and hale tie-down gear provided by the ship's crew.

These ships can, if necessary, be used to carry general cargo. They can load and discharge cargo with their own cargo-handling gear. The GTS *Wm. M. Callaghan* has two 120-ton jumbo booms for heavy lifts.

The flexibility of the RORO ship gives it many advantages. The specific number of vehicles carried depends on their size. The major factor is the square feet of space a specific type of vehicle will take up. The loading and discharging time alongside a pier is determined by how rapidly the vehicles are driven onto or off the ship. The great advantage here is the rapid handling of cargo and the reduced port time for the ship. In the event of an emergency, these ships can load or discharge in a LOTS operation. It may not be as rapid, but it is successfully done.

The most recent roll-on-roll-off ship is the Matson Navigation Company's *SSLurline*, which entered service in late 1973 on the West Coast-Hawaii trade route. She has a length overall of 700 feet, a beam of 105 feet, a loaded draft of 28 feet, and a speed of 24 knots. She can carry a combination of different sized trailers equivalent to 278 40-foot units, including 100 reefers (refrigerated units), and 207 automobiles. She can be loaded or discharged rapidly via huge steel ramps through three ports in the starboard side. The trailers are stowed aboard the ship in four special cargo decks with three lower decks forward for automobiles. They are held in place by lashings and supports on the deck. The *Lurline* and a sister ship use the Rolac system for securing trailers on deck. Under this system a steel support member which comes aboard ship already attached to the trailer secures the trailer to the deck as the tractor moves it and the support into the allotted space.

The coming of the roll-on-roll-off vessels added a new dimension for shipping vehicles aboard vessels. They also changed the method for loading and storage of helicopters. When helicopters were shipped aboard conventional vessels, the aircraft was vertically stripped and packed in its smallest configuration. The rotary tail blade and tail boom were removed, and the field skids were removed and replaced with smaller, lower shipping skids. At the port of discharge, the helicopters were unloaded from the vessel and the receiving unit had to spend numerous man hours making the aircraft ready for flight.

When helicopters are shipped aboard a RORO vessel, they are loaded in approximately their flying configuration. The only thing removed is the tail rotor blade. An exception is the CH 47 Chinook, whose rotary blades must be removed. Even though helicopters may have ground wheels installed to allow easy movement of the aircraft on the ground, they cannot be pushed in the ship and stored. The angle of the ramp will not allow enough clearance for the skids. Therefore, the helicopters must be loaded through the hatch of the vessel or stowed on the weather deck.

A helicopter with the rotor blade attached is carefully lowered through the hatch diagonally. The tail and nose of the helicopter are guided through the hatch opening by the terminal operations coordinator. This is to prevent the aircraft bumping against the hatch and hatch covers. Once the tail is below the hatch, the helicopter is moved backwards into the wing until the main rotor is in the square of the hatch. The helicopter is then lowered onto the deck, ground wheels are installed, the cargo hook is disconnected and



then the helicopter is moved to its stowage site. At the stowage site, a roller conveyor may be used to move the helicopter sideways into its final tie-down position. The tie-down is accomplished by using peck and hale lashing gear.

The CH 47 Chinook is hoisted aboard the vessel and stowed on the weather deck only. It is also tied down with peck and hale gear. The wheels are stabilized by placing a wooden frame around the wheel.

SUMMARY

The more standardization is added to the shipping industry, the faster and more efficiently we'll be able to load and unload ships. Containers, preloaded barges, LOTS operations and RORO procedures can only help. They give us more alternatives in how, when, where, and how fast we can load and unload ships than ever before.

How does this affect the Transportation Operations Coordinator? Well, see for yourself. Shipboard cargo booms and winches are slowly

becoming a thing of the past. Time spent building shoring, bulkheads, and decking may be the next thing to go. Standardized cargo is already cutting down the need for it.

As these special handling operations become more and more standard, the successful Terminal Operations Coordinator will be the one who understands and tends to the specific needs of these up and coming cargo handling operations. That can be you.



CHAPTER 9 MARKING AND TALLYING CARGO

What would you do if a ship came in with a load of various types of cargo and none of it was addressed or accounted for? You wouldn't know where it was coming from or going to. You wouldn't know what you were handling. You also wouldn't know whether it was all there or not. No amount of effective unloading operations would make up for the time that would be lost trying to identify the cargo.

In this chapter we will discuss our "paper tools." We will explain address markings, special handling labels and documentation procedures. In documentation, we will discuss the Transportation Control and Movement Document (TCMD) as well as how to tally (account for) the cargo piece by piece. As you will see, these labels, markings, and documents can be as important to you as the cranes, booms, and forklifts.

ADDRESS MARKINGS

The address markings tell where the shipment is coming from and where it is going. Cargo address markings are required on all items being shipped overseas or in the United States. An ex-

ception to this is when the shipment consists of a full truckload shipped by a consignor to a single CONUS consignee.

METHODS USED

The method of applying the address depends upon the type of container and the transportation priority of the shipment. The three methods used are **labels**, **tags**, and **stencils**.

Labels are preprinted forms that are glued to the package to be shipped. Shipping labels are used on boxes, crates, drums, and other containers when practical.

Tags are preprinted cards that have a hole at the center of one end and a string attached through the hole for tying the tag to the cargo. Tags are used on SEAVANS/MILVANS, cloth bags, and other items when it is impractical to apply a label or stencil.

Stencils are used when space or material surface permits and when the shipment has a low transportation priority that does not require an expedited handling label or tag. Stencils are locally produced address markings that are normally made by punching out alphanumeric characters on stencil paper using a stencil cutting machine. The stencil is put up against the crate and is then painted over. The stencil is then

removed, leaving clear block letters on the crate. Consideration is given to the different transportation priorities when marking cargo.

TRANSPORTATION PRIORITY 3 (TP-3)

Since transportation priority 3 shipments do not require expedited handling, the address marking for shipments entering the Defense Transportation System (DTS) are marked on DD Form 1387 (Military Shipment Label) or 1387-1 (Military Shipping Tag). A plain white label can be used when the label or tag is not available and the shipment is being made to a CONUS consignee.

TRANSPORTATION PRIORITY 2 (TP-2)

The shipping address for transportation priority 2 shipments is marked on a **blue-bordered** DD Form 1387-20 (Military Shipping Label) or a 1387-1-20 (Military Shipping Tag). When it is not practical to use a label, the transportation priority block of the shipping label or tag is marked with a large **blue numeral 2**.

TRANSPORTATION PRIORITY 1 (TP-1)

A **red-bordered** DD Form 1387-19 (Military Shipping Label) with a large **red numeral 1** printed in the TP block is used for transportation

priority 1 shipments. When the situation dictates, the DD Form 1387-1-19 (Military Shipping Tag) is used.

DATA ELEMENTS

Regardless of whether a stencil, label, or tag is used for the shipment address marking, the format and the information contained in the address markings are basically the same.

TRANSPORTATION CONTROL NUMBER ①

The first line of the address on a cargo shipment label is the TCN. This is the most important piece of information in the address because it is the reference point for all MILSTAMP documents, shipping actions, and tracer actions.

The TCN is a 17-digit number/letter code group assigned to a shipment unit to identify and control the shipment throughout the transportation system. There are two types of transportation control numbers, MILSTRIP and NONMILSTRIP. The section in this chapter that discusses the TCMD explains the TCN in detail.

REQUIRED DELIVERY DATE (RDD) ②

This indicates the Julian date the requisitioner expects his shipment. When it is necessary to expedite a shipment because of urgent demands, the expedite handling code "999" is used instead of the Julian date. Code "999" identifies the shipment as a critically needed item which should receive the highest priority in processing and shipping. Further when a shipment is identified as a code "999" item, a red and white 999 label is put on the front and back of the container.

PROJECT CODE ③

The project code is a three-position code used to identify a shipment made in support of a specific project, a program, a special exercise, or a maneuver. When a project code is not assigned, the shipper leaves this block blank.

TRANSPORTATION PRIORITY ④

Each shipment moving in the DTS is assigned a transportation priority (TP) number which influences the mode of transportation to be used in order for the shipment to be delivered to the consignee by the required delivery date (RDD). The shipping Transportation Officer assigns the TP to the shipment based on information found on supply release documents.

FROM ⑤

The shipper's *coded* and *in-the-clear* addresses are placed in this space. The coded address is taken from the Department of Defense Address Directory.

TO ⑥

When a shipment is going direct from a shipper to the requisitioner without going through an aerial or water port, the coded and in-the-clear address of the consignee (receiver) is placed in this block.

PORT OF EMBARKATION (POE) ⑦

When a shipment is going to an aerial or water port for onward movement to an overseas location, the coded and in-the-clear address of the port of embarkation is placed in the same block as the **TO** address.

The coded address for each air and water terminal is found in MILSTAMP Appendix K, DOD 4500-32R.

PORT OF DEBARKATION (POD) ⑧

The POD is the coded and in-the-clear address of the aerial or water port that will discharge the cargo when it arrives in the overseas area.

TRANSPORTATION CONTROL NUMBER (1) AT4015 9250 2026 XXX		RDD (2) 096	PROJECT (3) QRP
FROM: A25TBB TOBYHANNA ARMY DEPOT (5) TOBYHANNA, PA 18466		TRANS PRIORITY (4) 3	
TO: (POE when applicable) 3DK MILITARY OCEAN TERMINAL OAKLAND, CA. (6) (7)			
POD (When applicable) (8) UC2 INCHON, KOREA			
ULTIMATE CONSIGNEE OR MARK FOR			
PIECE NUMBER	TOTAL PIECES	WEIGHT THIS PIECE	CUBE THIS PIECE

DD FORM 1387, 1 APR 66

EDITION OF 1 APR 63
WILL BE USED.

MILITARY SHIPMENT LABEL

DD FORM 1387

DD FORM 1387-1 1 MAR 70 EDITION OF 1 APR 66 MAY BE USED. MILITARY SHIPPING TAG	TRANSPORTATION CONTROL NUMBER (1) AT4015 9250 2026 XXX		RDD (2) 096	PROJECT (3) QRP	TRANS PRIORITY (4) 3
	FROM: A25TBB TOBYHANNA ARMY DEPOT TOBYHANNA, PA 18466 (5)				
	TO: (POE when applicable) 3DK MILITARY OCEAN TERMINAL OAKLAND, CA. (6) (7)				
	POD (When applicable) UC2 INCHON, KOREA (8)				
	ULTIMATE CONSIGNEE OR MARK FOR				
					PIECE NUMBER
					TOTAL PIECES
					WEIGHT THIS PIECE
					CUBE THIS PIECE

DD FORM 1387-1

TRANSPORTATION CONTROL NUMBER AT4015 9250 2026 XXX		RDD 096	PROJECT QRP
FROM: A25TBB TOBYHANNA ARMY DEPOT TOBYHANNA, PA 18466			TRANS PRIORITY 3
TO: (POE when applicable) 3DK MILITARY OCEAN TERMINAL OAKLAND, CA.			
POD (When applicable) UC2 INCHON, KOREA			
ULTIMATE CONSIGNEE OR MARK FOR AT 4015 US ASCOM DEPOT (9) BUPYONG, KOREA			
PIECE NUMBER 3 (10)	TOTAL PIECES 9 (11)	WEIGHT THIS PIECE 437 (12)	CUBE THIS PIECE 73 (13)

DD FORM 1387, 1 APR 66 EDITION OF 1 APR 63 WILL BE USED. MILITARY SHIPMENT LABEL

DD FORM 1387

EDITION OF 1 APR 66 MAY BE USED.

 DD FORM 1387-1
1 MAR 70

MILITARY SHIPPING TAG

TRANSPORTATION CONTROL NUMBER AT4015 9250 2026 XXX		RDD 096	PROJECT QRP	TRANS PRIORITY 3
FROM: A25TBB TOBYHANNA ARMY DEPOT TOBYHANNA, PA 18466				
TO: (POE when applicable) 3DK MILITARY OCEAN TERMINAL OAKLAND, CA.				PIECE NUMBER (10) 3
POD (When applicable) UC2 INCHON, KOREA				TOTAL PIECES (11) 9
ULTIMATE CONSIGNEE OR MARK FOR AT 4015 US ASCOM DEPOT (9) BUPYONG, KOREA				WEIGHT THIS PIECE (12) 437
				CUBE THIS PIECE (13) 73

DD FORM 1387-1

ULTIMATE CONSIGNEE (9)

The **ULTIMATE CONSIGNEE OR MARK FOR** block is used only with overseas shipments. This block is not required for domestic shipments as the ultimate consignee has already been indicated in the **TO** block of the address marking. Overseas shipments require the **ULTIMATE CONSIGNEE** block for the coded and in-the-clear address of the consignee, as the **TO** block has already been used for the port of embarkation address.

PIECE NUMBER (10) AND TOTAL PIECES (11)

Each piece of cargo in a shipment is numbered sequentially from 1 through 2, 3, 4, 5, etc. until each piece is assigned a number. The total pieces is the highest sequence number in the shipment. For example, if you sent six crates of oranges to Maine, each crate (piece) will get a number. The second crate numbered will be crate number two of six total pieces. A shipping piece number is applied to each container in a shipment except:

- Shipments of the same commodity in standard containers or packages.
- Full carload and truckload shipments of like items to a CONUS activity.

In addition to the individual piece number, the total number of pieces in the shipment is shown in the shipping address. When the address is stenciled on a container, the piece number is shown on the bottom line of the address followed by a slash and the total number of pieces in the shipment. When the shipment label or shipping tag is used, the piece number and total number

of pieces are entered in the blocks provided on the bottom line of the address.

WEIGHT (12)

The number found in this part of the address marking shows the gross weight (the combined weight of cargo, packing material, and container) in pounds.

CUBE (13)

For shipping purposes, the cubic measurement (cube) of a piece of cargo is expressed in cubic feet. Shipments are occasionally received for transshipment that do not show the cube of the container. When this occurs, the container should be measured by the checker and the cube should be properly marked on the container. The cube is computed by multiplying the length, width, and height of the container. If the measurements are not all even feet, all dimensions should be converted to inches and the total divided by 1728. This is the number of cubic inches in a cubic foot.

EXAMPLE: The measurements of an unmarked container are:

Length 5 feet 3 inches, width 4 feet 2 inches, height 3 feet 1 inch.

The cube is determined in the following manner:

Length - 5 feet 3 inches = 63 inches

Width - 4 feet 2 inches = 50 inches

Height - 3 feet 1 inch = 37 inches

$$\frac{63 \times 50 \times 37}{1,728} = \frac{116,550}{1,728} = 67.4 \text{ cubic feet}$$

SPECIAL MARKINGS

Don't you want to know when you're handling nitroglycerin? Well, in addition to address markings, many items moving in the DTS have special markings to give those who are handling, moving, or storing the freight various precautionary warnings or special handling instructions. Some

special markings are required by title 46 and 49 of the Code of Federal Regulations, International Maritime Dangerous Goods Codes, and Military Standard 129. Others are added at the discretion of the shipper.

HAZARDOUS MATERIAL

So that you can easily identify hazardous cargo, each of the fourteen hazardous commodity classifications has a distinct colored label. Cargo that requires a hazardous material label is referred to as "label cargo." The labels are over-stamped or overprinted with the appropriate

United Nations class number located in the bottom corner of the label as required on MIL-STAMP documentation. Refer to Appendix H for a complete description of all hazardous cargo labels.

PRECAUTIONARY AND SPECIAL HANDLING INSTRUCTIONS

In addition to the colored hazardous cargo labels, various other precautionary warnings and handling instructions are put on the outside of containers and items of equipment when special handling is required. For some types of cargo and under certain shipping conditions, these warnings and handling instructions are required by Government regulatory agencies, federal laws, or military regulations. In other cases, the markings are applied only for the purpose of protecting the fragile or sensitive contents of a container from damage that could be caused by improper handling or storage. During cargo transfer operations, cargo checkers should be especially watchful for these markings and bring them to the attention of the cargo handlers when an item is being improperly handled or stored.

FRAGILE



Containers packed with delicate or fragile articles are marked **FRAGILE** in *at least three locations*. Red-bordered fragile labels may be used, or the word **FRAGILE**, the fracture symbol, and a red border may be stenciled or printed on the container.

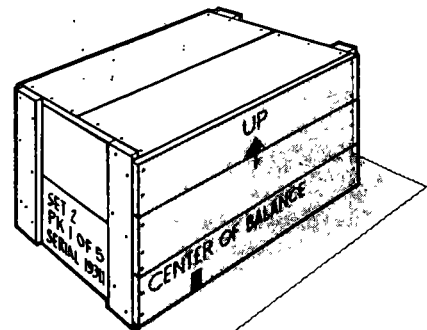
When containers are marked with precautionary markings, e.g., **GLASS—DO NOT DROP OR THROW**, or **GLASS—HANDLE WITH CARE**, the **FRAGILE** marking is not required.

ARROWS

Many items moving in the DTS must be shipped, handled, and stored in an upright position in order to reduce the possibility of leakage or damage. The shipping containers for these types of items are marked on at least two sides with an arrow and the word **UP** to indicate the top surface of the container.

CENTER OF BALANCE

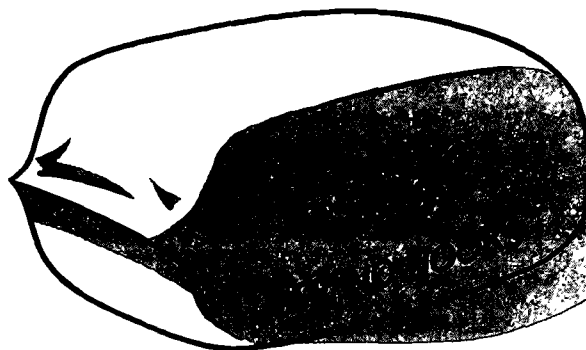
Cargo handling operations involving the lifting of vehicles and other equipment are extremely dangerous when performed in an improper manner. Since the physical characteristics of different types of equipment vary,



shippers usually provide instructions on where to attach lifting slings on unboxed equipment and indicate the location of the center of balance on large or unbalanced containers. The lifting points on unboxed vehicles are marked with a 1-inch-wide line on both sides of the container, and the words **CENTER OF BALANCE** are stenciled or printed above or alongside the line.

USE NO HOOKS

Hand-held bag hooks are sometimes used by cargo handlers to move cloth-wrapped bundles or bales. Since the use of these hooks on items such as burlap-wrapped tarpaulins or clothing will result in damage, the legend **USE NO HOOKS** and a hook symbol with an X over the symbol are stenciled on two sides of the bundle when use of hooks is prohibited.



NOTE: MIL-STD-129 emphasizes that special handling markings are to be used only on those items actually requiring such handling.

COMMODITY CATEGORY MARKINGS

In addition to other nomenclature and identification markings, MIL-STD-129 provides for color marking symbols for different commodities of supplies and equipment being shipped overseas. With the exception of medical supplies, these color marking symbols are used only when specified by a Military Department. This additional marking requirement usually occurs only when a large volume of supplies and equipment is being shipped in support of combat operations. The application of color marking symbols for medical supplies being shipped to overseas units is required at all times.

When the commodity color marking symbols are used, a cargo checker who knows the different colored symbols can determine the type of cargo in a container at a glance. This system is extremely helpful when supplies are being sorted by commodities or when a priority requirement exists for a specific item.

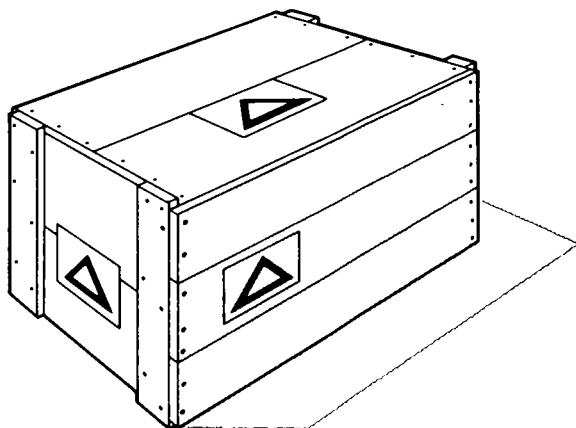
CATEGORY SYMBOLS AND LABEL COLORS

When color coding cargo is required, special colored labels with black symbols are used. The labels measure 3 by 3 inches to 10 by 12 inches depending upon the size of the container.

CATEGORY	SYMBOL LABEL	BACKGROUND
TANK-AUTOMOTIVE		YELLOW
ELECTRONICS		ORANGE
CONSTRUCTION & MHE		RED
RAIL & MARINE		RED
WEAPONS		YELLOW
GENERAL SUPPLIES		GREEN
CLOTHING & TEXTILES		GREEN
PUB.-PRINTED MATTER-STATIONERY		WHITE
AIRCRAFT COMPONENTS/AVIONICS		BLUE
MISSILE		YELLOW
MEDICAL		MAROON
POL STORAGE & DISPENSING EQUIP		GREEN
POL		WHITE OR YELLOW

MARKING REQUIREMENTS

Except for MILVANS and SEAVANS, four-color marking symbol labels are applied to each rectangular shipping container, one on each side, one on an end, and one on top.



When a container, palletized load, or transporter consists of two or more commodities, the labels are put only on the interior containers. The labels are applied to MILVANS or SEAVANS under any conditions. Loose unpacked items are marked by applying the color marking symbol labels to both sides of a tag which is attached to the item.

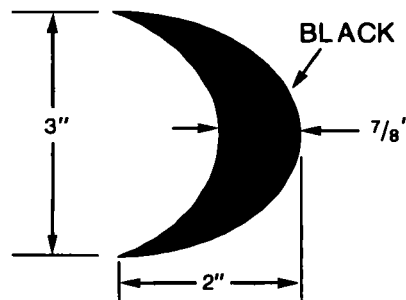
EXCEPTIONS

The color marking symbol labels are not used on the following categories of cargo.

Major unpacked items that are easily recognizable, such as vehicles, artillery pieces, or boats.

Explosives and other dangerous articles that are marked with the distinctive color labels. The use of additional colored labels is forbidden by Federal statutes and military regulations.

Perishable and nonperishable subsistence items (except items for resale) which are always identified by stenciling or printing a solid black crescent on the shipping container.



TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT

The form used by the cargo checker to record or tally the cargo data is called the Transportation Control and Movement Document, or TCMD. The TCMD is an official document that is signed by the checker as being accurate, used by other individuals to prepare additional documents, and later filed as part of the record. It may also be used to provide advance notice to the receiving terminal. Cargo checkers are not normally required to prepare TCMDs, so only a general description of some of the code entries is provided in this chapter.

A separate TCMD must be prepared for each shipment entering the transportation system. They may be machine prepared, as a punch card or an administrative message, or they may be a manually prepared TCMD (DD Form 1384).

Under most circumstances, the TCMD (DD Form 1384) or a computer print-out of TCMD data is available. The cargo checker may have to record cargo data on a locally produced form. In this section we will explain how to fill out a TCMD, DD Form 1384. This section is important even if you don't plan to fill one out. By understanding how to prepare it, you'll know what the information in each block means. You can refer to the following illustrations to see what it looks like when filled out.

BLOCK 1

The Document Identifier Code (DIC) is a three-character code which indicates the purpose for which the form is being used (example: advance TCMD, air manifest, or water manifest documents) or the type of shipment it relates to. The

TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT																PAGE NO.																					
1. Doc Id		2. Trlr Cont		3. Consignor			4. Comm-Spec Hdg			5. Air Dtm		6. POR			7. POD																						
TH1				A25TAB			390EX																														
8. Mode		9. Pack		10. Trans Control No.			11. Consignee			12. Pri		13. RDD		14. Proj		15. Date Shpd		16. ETA		17. Tr Act																	
18. Carrier			19. Flight-Truck-Voy Doc No.			20. Ref			21. Remarks			22. Pieces			23. Weight			24. Cube																			
25 a. Tranship Point (1)				b. Date Rec		c. Say Whse		d. Date Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.			g. Ref.		h. Stow Loc		i. Spltd		j. Cond		k. Signature-Remarks														
26 a. Tranship Point (2)				b. Date Rec		c. Say Whse		d. Date Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.			g. Ref.		h. Stow Loc		i. Spltd		j. Cond		k. Signature-Remarks														
27 a. Tranship Point (3)				b. Date Rec		c. Say Whse		d. Date Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.			g. Ref.		h. Stow Loc		i. Spltd		j. Cond		k. Signature-Remarks														
28. Consignee				29. Date Received-Offred (Sign)				30. Condition				31. Remarks																									
32. Doc Id		33. Trailer-Container		34. Consignor Comm Abbr Other		35. Commodity Spec Hdg		36. VOY NO AU Dim a		37. POE b		38. POD		39. M O D E		40. Type Pack		41. Transportation Control Number		42. Consignee		43. REMARKS AND/OR F R I RDD a		b. Proj		c. Stow Loc Shpd b		d. ETA		e. Tmc		44. ADDITIONAL REMARKS OR Pieces a		Weight b		Cube c	

DIC also specifies the format for additional transportation that is required.

As an example, MILSTAMP manual, Appendix B, indicates that the letter "T" identifies the form as a MILSTAMP document. The letter "H" in the second position identifies the shipment as household goods. The third character, number 1, indicates that the document is being used as the principal shipping document for a single shipment that does not require clearance approval prior to shipment.

BLOCK 2

Where a shipment is moving in a controlled container, MILVAN, or SEAVAN, the last 5 digits of the container number will be entered in this block.

For roll-on/roll-off (RORO) containers the last four digits of the container number will be preceded by an "S" or "V" to indicate whether it is a stake and flat bed or a van.

When two or more shipment units are consolidated into a noncontrolled container (containers without permanent serial numbers), the assigned container serial number will be preceded by the shipping service code, A-Army.

BLOCK 3

The coded or in-the-clear address of the shipping installation, unit, or other agency appears in this block.

This address code should be the same as the one appearing in the **FROM** block of the Military Shipment Label, Military Shipping Tag, or other address marking appearing on the shipping container.

BLOCK 4

The information appearing in this block provides a quick means of identifying material for manifesting, customs requirements, stevedore billing, and transportation cost.

It also provides an indication of whether the shipment requires special attention during shipment, handling, or storage.

The Water Commodity and Special Handling Code is a five-or six-position alpha, alphanumeric or numeric code or abbreviation used to identify a specific piece of cargo. It tells cargo handlers that there is a special way to handle this particular shipment. The five-character Water Commodity Code is developed in the following manner:

Fifth position — exception/handling.

The second character indicates any special handling or attention that may be required; if none is required, the code "Z" is used. It should be noted that when the second character of the code is other than "R," "Z," or a numeral, a special Handling Data/Certification Label (DD Form 1387-2) must be attached to the shipment. Cargo checkers and warehousemen can obtain detailed handling instructions by referring to that label.

The air dimension code is used only for shipments moving by aircraft. It identifies the type of cargo aircraft capable of transporting the largest container in the shipment. This code is found in Appendix B of the MILSTAMP manual.

A port of embarkation (POE) is an air or ocean terminal at which troops, equipment, or material are loaded aboard aircraft or vessels. Every terminal throughout the world that is used in the transportation of DOD shipments is assigned an identification code. Ocean terminal codes indicate the major geographical area, the sub-area, and the specific port, port area, or island. The list of water port designators found in the MIL-STAMP manual, Appendix B, indicates the POE code 3DK is located at the Military Ocean Terminal, Bay Area (Oakland, California).

Air Terminal Identifier Codes are three-position alpha codes that are used to identify the name and location of air terminal. For example, the code for McGuire AFB, Wrightstown, N.J. is **WRI**.

TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT															PAGE NO.	
1. Doc Id	2. Trlr Cont	3. Consignor	4. Comm-Spec Hdg		5. Air Dm	6. POE	7. POD									
TH1		A25TAB	390ZZ			3DK	UD6									
8. Mode	9. Pack	10. Trans Control No.	11. Consignee		12. Pri	13. RDD	14. Proj	15. Date Shpd	16. ETA	17. Tr Acct						
B	CR	A296499149266HXX														
18. Carrier	19. Flight-Truck-Voy Doc No.		20. Ref		21. Remarks		22. Places		23. Weight	24. Cube						
25 a. Tranship Point (1)			b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.		g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks			
26 a. Tranship Point (2)			b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.		g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks			
27 a. Tranship Point (3)			b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.		g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks			
28. Consignee			29. Date Received-Offered (Sign)		30. Condition		31. Remarks									
32. Doc Id	33. Trailer-Container	34. Consignor Comm Abbr Other	35. Commodity Spec Hdg	36. VOY NO.	37. M O D E	38. Type Pack	40. Transportation Control Number		41. Consignee	42. P R I	43. REMARKS AND/OR			44. ADDITIONAL REMARKS OR		
											a. RDD	b. Proj	c. Stow Loc	d. ETA		
											e. Split	f. Tnc	g. Places	h. Weight		
											i. Cube					

BLOCK 7

The same code system as that used for POE's is used to identify the air or ocean terminal where the shipment is designated to be unloaded.

A 2 6 T A M	1 0 9 6	1 0 3 1	X X X
1	2	3	4 5 6

BLOCK 8

Advanced information as to the mode of transportation by which the shipment is arriving will be entered in this block. This information will enable terminal personnel to prepare for arrival of the particular conveyance.

1. Activity address code
2. Year and Julian date of requisition
3. Requisition serial number
4. Suffix to requisition when filled by more than one supply agency
5. Partial shipment indicator
6. Split shipment indicator

BLOCK 9

Pack refers to the method of packaging a shipment unit or units together. The methods used are indicated by one of the abbreviations listed in Appendix C.

AK473120940100XAX — 1st Increment

AK473120940100XBX — 2nd Increment

BLOCK 10

Cargo checkers are particularly interested in the TCN, since during the process of checking cargo they must compare this TCN with the TCN entered in the address marking of the container. The comparison of these two numbers is the most effective way of correctly identifying a shipment. The following illustration shows the data contained in a MILSTRIP TCN.

AK473120940100XZX — Last Increment

The Activity Address Code is a six-position alphabetic-numeric code which identifies the initiator or requisitioner of supplies.

The Date of Requisition is a four-position numeric code showing the date the request for supplies was forwarded to the initial supply source. The first number shows the last numeric digit of the calendar year. The last three numbers

TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT														PAGE NO.																
1. Doc Id		2. Yrs Cont		3. Consignor			4. Comm-Spec Hdq			5. Air Dm		6. POB		7. POD																
TH1				A25TAB			390ZE			3DK				UD6																
8. Mode		9. Pech		10. Trans Control No.			11. Consignee			12. Pch		13. ADD		14. Proj		15. Data Shpd		16. IFTA		17. Tr Acct										
B		CR		A25549949266W			AT677			3		320																		
18. Carrier				19. Flight-Truck-Voy Doc No.				20. Ref				21. Remarks				22. Pech				23. Weight		24. Cube								
25 a. Tranship Point (1)				b. Date Rec		c. Bay Whse		d. Data Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.				g. Ref.		h. Stor Loc		i. Spld		j. Cond		k. Signature-Remarks						
26 a. Tranship Point (2)				b. Date Rec		c. Bay Whse		d. Data Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.				g. Ref.		h. Stor Loc		i. Spld		j. Cond		k. Signature-Remarks						
27 a. Tranship Point (3)				b. Date Rec		c. Bay Whse		d. Data Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.				g. Ref.		h. Stor Loc		i. Spld		j. Cond		k. Signature-Remarks						
28. Continues				29. Date Received-Offered (Sign)				30. Condition				31. Remarks																		
32. Doc Id		33. Trailer-Container		34. Consignor Comm Abbr Other		35. Commodity Spec Hdq		36. VOY NO. Air Dm a POE b		37. POD		38. M O S		39. Type Pack		40. Transportation Control Number		41. Consignee		42. P R I		43. REMARKS AND/ OR ADD a Proj b Wtr Loc Shpd c IFTA d Tcr e						44. ADDITIONAL REMARKS OR Pech a Weight b Cube c		

show the numeric consecutive day of the calendar year.

The Requisition Serial No. is a four-digit numeric code assigned by the initiator or requisitioner. Serial numbers are assigned on a daily basis ranging from "0001" to "9999"

A Suffix Code is a one-digit alpha code assigned to show partial fill of a requisition. If there is no suffix code assigned on the DD Form 1348-1, an "X" is used in this position.

The Partial Shipment Code is used by the depot or shipper only. When cargo is moved from a depot or shipper in one truck load, an "X" is used in this position. When the shipment unit requires partial shipment, the TCN for the first increment would have a partial shipment code of "A," the second "B"; and so on through the alphabet as required except for "X," because "X" indicates a complete shipment. When shipment codes are used, the last increment of the shipment ends with code "Z."

The Split Shipment Code is reserved for use by terminal or transshipment activities. The depot or other shipping activities always assign the Code "X" to this 17th position.

A non-MILSTRIP TCN is assigned by the origin transportation officer for cargo shipments that are not directed for movement by supply action such as household goods, SEAVANS, privately owned vehicles, MILVANS, and mail.

Refer to MILSTAMP DOD 4500-32R, Appendix D, for details on how to construct these TCN numbers.

BLOCK 11

The consignee is the unit that will receive the cargo. The activity address code entered in this block should be the same as that entered in the TO block of the address marking, or the ULTIMATE CONSIGNEE block if the shipment is to be shipped overseas.

BLOCK 12

The transportation priority (TP) entered in this block should be the same as the TP appearing on the address marking.

BLOCK 13

The required delivery date (RDD) is the Julian Calendar date by which the shipment must be delivered to the consignee.

TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT																	PAGE NO.																		
1. Doc Id		2. Trk Cont		3. Consignee			4. Comm-Spec Hdg			5. Alt Dtn		6. POE			7. POD																				
TH1				A25TAB			390ZZ					3DK			UD6																				
8. Mode		9. Pack		10. Trans Control No.			11. Consignee			12. Pri		13. RDD		14. Proj		15. Date Shpd		16. STA		17. Tr Act															
B		CR		A295449/49266HXX			ATG77			3		320				295		4		A175															
18. Carrier		19. Flight-Truck-Voy Doc No.			20. Rd		21. Remarks									22. Pieces		23. Weight		24. Cube															
XYZ TRK CR.																																			
25 a. Tranship Point (1)				b. Date Rec		c. Bay Whse		d. Date Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.			g. Ref.		h. Stow Loc		i. Splt		j. Cond		k. Signature-Remarks												
26 a. Tranship Point (2)				b. Date Rec		c. Bay Whse		d. Date Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.			g. Ref.		h. Stow Loc		i. Splt		j. Cond		k. Signature-Remarks												
27 a. Tranship Point (3)				b. Date Rec		c. Bay Whse		d. Date Shpd		e. Mode Carrier		f. Flight-Truck-Voy Doc No.			g. Ref.		h. Stow Loc		i. Splt		j. Cond		k. Signature-Remarks												
28. Consignee				29. Date Received-Offered (Sign)				30. Condition				31. Remarks																							
32. Doc Id		33. Trailer-Container		34. Consignee Comm Abbr Other		35. Commodity Spec Hdg		36. VOY NO. Alt Dtn a		37. POD		38. M D E		39. Type Pack		40. Transportation Control Number		41. Consignee		42. P R I		43. REMARKS AND/OR				44. ADDITIONAL REMARKS OR									
								FOE b												RDD a		Proj b		Stow Loc Shpd c		FOE d		Tnc e		Pieces a		Weight b		Cube c	

BLOCK 14

This block is left blank unless the shipment unit is moving in support of a project which has been assigned a specific identification code. Again, the shipping transportation officer will extract this information from the supply release documents when the TCMD is prepared.

BLOCK 15

The Julian date entered in this block is the date the shipment is released to the carrier or the POE when the shipper is located in the vicinity of the POE.

When the TCMD is for an air shipment, only the last two characters of the Julian calendar are used. They will be preceded by a single-character hour code to indicate the anticipated hour of release to the carrier at the point of origin.

BLOCK 16

The ETA (estimated time of arrival) is actually the estimate of the number of days the shipment will be in transit to the POE.

BLOCK 17

Military services and other DOD agencies that use the defense transportation system are required to pay for the transportation and terminal services involved in the movement of shipments

within the system. Four-character transportation account codes are assigned to these agencies to facilitate shipper identification for cost accounting and billing purposes.

BLOCK 18

Enter the name of the trucking company, airline, railroad, or ship that moves the cargo.

BLOCK 19

Enter the license number of the truck or trailer the cargo is loaded in. If the shipment is going by air or vessel, enter the mission or voyage number. These numbers may be obtained from the Military Sea Command representative or Military Airlift Command representative. MILSTAMP provides that entry of this information is optional. However, local policy may dictate that the name of the carrier and vehicle number be placed in these blocks.

BLOCK 20

The use of this block is optional. It should not include remarks that would apply to the shipment beyond the APOE/POE.

BLOCK 21

This block is used only when a shipper is providing information which is not applicable to the

10

to accommodate three separate transshipments. The information that the cargo checkers enter in blocks "a" through "k" is used to prepare manifests, vessel stowage plans, and a number of other documents. Therefore, the cargo checker must thoroughly understand how to record the correct information in the appropriate block. Detailed instructions for completing this portion of the form are provided in the section that discusses steps used in tallying cargo in this chapter.

BLOCKS 28 THROUGH 31

These blocks are completed by the consignee when the shipment has been delivered. When these blocks have been completed, the consignee will have a record of when the shipment was received and its condition upon arrival. A copy of the completed TCMD, signed by the consignee, may also be given to the delivering carrier as a delivery receipt to verify that the shipment has been completed.

BLOCKS 32 THROUGH 44

This portion of the form is used to provide supplemental information for special categories of shipments. When used for this purpose, the information is referred to as "trailer data" or "header data," depending upon the type of shipment it describes. Trailer data provide additional information for a single shipment unit

This portion of the form is completed by a cargo checker each time the shipment is transferred from one carrier to another, from a carrier to a temporary storage location, or from a temporary storage location to a carrier. The form is designed

(described in blocks 1 through 24), whereas header data identify the RORO trailer, SEAVAN, or consolidation container that the shipment is moving in. When mechanically prepared punch card TCMD's are used as prime documents, the supplemental information must be entered on separate punch cards. These supplemental cards accompany the prime document (TCMD) and are referred to as "trailer" or "header" cards. When the manually prepared DD Form 1384 is used as a prime document, these cards are not required. MILSTAMP DOD 4550-32R, Appendix B, identifies the data in these blocks as personal property ownership data.

A terminal operations coordinator receives the TCMD; interprets the information recorded on it; and adds additional information as cargo is loaded or discharged from vehicles or vessels, or transferred within the terminal. The cargo checker must know if the cargo he is receiving or about to receive is dangerous, how many pieces there are in the shipment, and what type of pack the cargo was shipped in. This information and more is on the TCMDs. When received by the terminal operations coordinator, the need is only to interpret the information given, compare it with information recorded on the shipment label, and make a cargo tally. The TCMD is a valuable tool.

CARGO TALLYING METHODS

Checking cargo involves two general functions:

- Inspecting cargo for quantity, condition, and identifying marks
- Making observations a matter of record.

The second function is referred to as "tallying." Any method of tallying cargo may be used that quickly provides an accurate and legible

cargo count. The cargo count is recorded on a tally sheet. A tally sheet may be a TCMD, a computer printout or a locally produced form. The best method for tallying one type of cargo, such as boxes of rations, may not be the most accurate method for another type of cargo, such as serial numbered vehicles or individually numbered packages. To satisfy various requirements, four tallying methods are in general use in the Army: **Package, Unit, Block, and Straight.**

PACKAGE METHOD

When the TCMD indicates more than one piece of cargo was shipped under the same TCN, and each piece of cargo has its own label, the package method of tallying cargo is used. When using this method, the cargo checker lists each piece number on his tally sheet. As each numbered piece is discharged, he crosses out the corresponding number on his tally sheet. For example, pieces 1, 3, and 5 of a five-piece shipment have been loaded. They are marked off as follows:

~~1~~ 2 ~~3~~ 4 ~~5~~

The piece number and total number of pieces are shown at the bottom of the address label. If a piece is damaged or missing, the checker draws a circle around the appropriate piece number and identifies it as short or damaged. For example, if pieces 1, 3, and 5 of a five-piece shipment are loaded intact, piece number 2 is

damaged, and piece 4 is missing, the tallying sheet would look like this:

DAMAGED SHORT

~~1~~ (2) ~~3~~ (4) ~~5~~

As a result of marking or a shipping error, two pieces may bear the same number, making one of the pieces excess. In this case, the number of the extra piece will also be recorded on the tally, circled and annotated "over." For example, if the shipment had two pieces labeled with the number 3, the second number would be tallied as follows:

~~1~~ ~~2~~ ~~3~~ 4 ~~5~~ OVER (3)

NOTE: When a discrepancy of the type described is detected, the checker should circle

TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT																		PAGE NO.	
1. Doc Id	2. Trlr Cont	3. Consignor			4. Comm-Spec Hdig			5. Air Dim	6. POE	7. POD									
TX1		A26TBE			722Z9				1MJ	RG1									
8. Mode	9. Pack	10. Trans Control No.			11. Consignee			12. Pri	13. RDD	14. Proj	15. Date Shpd	16. ETA	17. Tr Acct						
B	PC	AK422410700031XXX			AK4224			3	130		077		A205						
18. Carrier		19. Flight-Truck-Voy Doc No.			20. Ref			21. Remarks											
25 a. Tranship Point (1)		b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.			g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks						
1MJ		078	C-23		TRUCK	GBLG788760							R.M. Brown						
29 a. Tranship Point (2)		b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.			g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks						
27 a. Tranship Point (3)		b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.			g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks						
28. Consignee		29. Date Received-Offered (Sign)			30. Condition			31. Remarks											
32. Doc Id	33. Trailer-Container	34. Consignor Comm Abbr Other	35. Commodity Spec Hdig	36. VOY NO Air Dim a	37. POD	38. M O D E	39. Type Pack	40. Transportation Control Number	41. Consignee	42. P R I	43. REMARKS AND/ OR				44. ADDITIONAL REMARKS OR				
											RDD	Proj	Stow Loc	ETA	Tac	Pieces	Weight	Cube	
											a	b	c	d	e	a	b	c	
<i>Damaged Short over</i> <i>x ② ③ ④ ⑤ ③</i>																			

blocks "22," "23," and "24" of DD Form 1384, when it is being used as a tally sheet. Boldly drawn circles around these three blocks alert the documentation personnel to the fact that a dis-

crepancy exists. The cargo checker, using information on the shipping label, computes the weight and cube of cargo on hand and places this information in blocks 44 "a," "b," and "c."

UNIT METHOD

Equipment such as trucks, tanks, MILVANS, SEAVANS, and other large serial numbered

items that are handled separately are usually tallied by the unit method. By referring to the

TRANSPORTATION CONTROL AND MOVEMENT DOCUMENT																		PAGE NO.	
1. Doc Id	2. Trlr Cont	3. Consignor			4. Comm-Spec Hdig			5. Air Dim	6. POE	7. POD									
TVO		A25TBB			867ZE				1GC	JF1									
8. Mode	9. Pack	10. Trans Control No.			11. Consignee			12. Pri	13. RDD	14. Proj	15. Date Shpd	16. ETA	17. Tr Acct						
D	VO	AK43349209001XXX			AK4334			3	253		221		A205						
18. Carrier		19. Flight-Truck-Voy Doc No.			20. Ref			21. Remarks											
25 a. Tranship Point (1)		b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.			g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks						
65. Newersail		260											R.S. Rila						
29 a. Tranship Point (2)		b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.			g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks						
JF1		261	Yard										J.D. Smith						
27 a. Tranship Point (3)		b. Date Rec	c. Bay Whse	d. Date Shpd	e. Mode Carrier	f. Flight-Truck-Voy Doc No.			g. Ref	h. Stow Loc	i. Split	j. Cond	k. Signature-Remarks						
28. Consignee		29. Date Received-Offered (Sign)			30. Condition			31. Remarks											
32. Doc Id	33. Trailer-Container	34. Consignor Comm Abbr Other	35. Commodity Spec Hdig	36. VOY NO Air Dim a	37. POD	38. M O D E	39. Type Pack	40. Transportation Control Number	41. Consignee	42. P R I	43. REMARKS AND/ OR				44. ADDITIONAL REMARKS OR				
											RDD	Proj	Stow Loc	ETA	Tac	Pieces	Weight	Cube	
											a	b	c	d	e	a	b	c	
<i>TV5 M35 86727 1GC JF1 3 VO AK43349209001XXX AK4334 00255L096W111H USA 4L7671</i> <i>NOTE: Left side of windshield broken</i> <i>Left headlight broken</i> <i>Hood dented - J.D. Smith</i>																			

[illegible]

TALLYING BREAKBULK CARGO

There are a number of different types of transshipping functions which require the checking and tallying of cargo including: rail, truck, air, and inland barge transfer operations.

The unloading of cargo vessels in overseas ports of discharge (POD) is the function of terminal service companies. Discharge operations at the POD is the largest type of all transshipping functions. To illustrate the use of the DD Form 1384 as a cargo tally sheet, a description of the steps involved in moving breakbulk cargo through an overseas port is provided.

STEP 1.

Advance Manifest. Upon completion of vessel loading, the POE transmits the ocean cargo manifest data to the designated port of discharge (POD). The port of discharge uses the advance manifest information to make the TCMD prior to vessel arrival.

STEP 2.

Chief Cargo Checker. The Chief Checker distributes the tally sheets (TCMD) to the appropriate hatch checkers aboard vessels just prior to commencement of vessel discharge.

STEP 3.

Cargo Identification. As the cargo is discharged from the vessel, the cargo checker identifies the cargo by comparing the TCN which appears on the top line of the address marking with the TCN appearing in block "10" of the TCMD.

STEP 4.

Tallying Cargo. (By using one of the tallying methods previously discussed.) The checker enters his cargo count, discrepancies, and comments in the lower portion of the TCMD, and fills out line 25, blocks "a" through "k."

Transship Point. When the cargo is being checked into or off a ship, the vessel name or identification number is listed in this block. When cargo is being received into or relocated within the terminal, the appropriate three-position air or ocean terminal designator is entered in block "a." If the activity has not been assigned a code, the name of the locality will be spelled out in the clear.

Date Received. Enter here the Julian date on which an incoming shipment is checked off the transport mode.

Bay Warehouse. The warehouse the cargo is stored in and the particular bay within that warehouse is inserted in this block. If the cargo is left on the pier, then the word "pier" and pier number will be entered.

Date Shipped. The Julian date that a shipment is checked out of the terminal is entered into this block.

Mode Carrier. The entry recorded in this block provides a record of the means by which the shipment departed the terminal. The entry is spelled out in the clear such as:

- Rail
- Truck
- Aircraft
- Barge.

Flight-Truck-Voyage Document Number. Detailed identification of the carrier is established by the entry recorded in this block. Enter the Aircraft Flight Number, vessel voyage number or unit, and bumper number of military vehicles. When commercial vehicles are used, enter in this block the Government Bill of Lading (GBL) number which authorized the carrier to transport the shipment.

Reference. Leave blank.

Stowage Location. An entry is required to be made in this block only when cargo is being loaded aboard a ship. The entry will consist of a four-position vessel stowage location code described in MILSTAMP manual, Appendix B, DOD 4500-32R. Until a checker thoroughly learns the 71 elements of this code, it is recommended that they be reproduced and attached to his clipboard along with the tally sheets. An inaccurate entry in this block will be printed on the cargo manifest and other ship's papers and will create difficulties for the discharging terminal.

Split. Leave blank.

Condition. Leave blank. For cargo checking purposes, a "condition" entry is made in the lower part of the tally sheet.

Signature Remarks. The cargo checker's signature is entered in this block.

STEP 5.

TCMD Distribution.

Ship Side. The hatch checker aboard ship records his tally and attaches the six carbon copies of the DD Form 1384 to the shipment unit. The seventh copy is retained and turned in to the chief cargo checker.

Marshalling Yard. As the shipment is placed in a warehouse or other storage area, the intransit storage checker will use six copies to conduct his check of the cargo, enter his tally and record the appropriate entries in blocks "a," "b," and "c," and then place his signature in block "k" of line number 26. When the intransit storage checker has completed his tally, he will detach one copy of the tally sheet and secure the remaining five copies to the cargo. The detached copy is turned in to the documentation section, where it is used to update the terminal's cargo inventory record. If a shipment is transferred directly from ship to truck, railcar, or barge, the appropriate information would be recorded in blocks "a," "d," "e," and "f." Blocks "b" and "c" would be left blank.

When the cargo is late loaded aboard the carrier for shipment to the consignee, the cargo checker records his tally on the five copies attached to the cargo and enters the appropriate information on line number 27. At this point, the terminal policy may require preparation of a new document to be issued to the carrier as a freight waybill. Or the cargo checker may obtain the signature of the carrier, detach one copy to be retained in terminal records, and turn the other copies over to the carrier.

Consignee. Upon receipt of the shipment by the consignee, it is again checked for quantity and condition and the appropriate information is entered in blocks "28" through "31" by the consignee, with one copy returned to the carrier to be retained as a receipt of delivery.

TALLYING CONTAINERS

Cargo tallying provides a continuing record of the container from the time the container is unloaded from the ship until it is shipped from the marshalling area. To accomplish this, checkers are normally stationed at any or all of the following locations:

- Each working shipside crane (transfer between ship and transporter).
- Each hatch or cell being worked.

- Transfer point between lighterage and land transporter (LOTS operation).
- In the marshalling area:
 - Where containers are placed in, or removed from, the container stack.
 - Each container stuffing/stripping operation.
 - Yard entry/exit point.

INCOMING CONTAINERS

STEP 1.

For incoming containers, the documentation element gives the chief cargo checker a discharge tally list for the container to be tallied from the ship. If an automated system is not available, TCMDs may be used.

STEP 2.

The chief cargo checker distributes these documents to the appropriate checkers, who then use them as tally sheets. As a container comes off the ship, the checker compares the container serial number with that shown on the tally list (or TCMD, as appropriate), and:

- If the serial numbers agree, places a check mark on the tally beside the number. (If a listed container is not aboard the ship, the checker so notes opposite the container list number.)
- As appropriate, notes opposite the listed container number such irregularities as:

- Damage to the container or its contents.
- Broken or missing seals or locks, or indication of tampering or pilferage.
- A container seal number differing from that shown on the tally document.

STEP 3.

Cargo checkers record on the tally list serial numbers of containers unloaded from the ship but not included on the discharge tally list or for which no TCMD has been prepared.

STEP 4.

At the end of the shift, all cargo checkers meet the chief cargo checker to iron out any discrepancies. The chief then prepares a consolidated tally list which is turned in to the documentation element.

CONTAINERS IN A MARSHALLING YARD

For containers arriving at the marshalling yard from shipside, the cargo checker verifies the container serial number against that shown on the discharge tally list and makes the appropriate entries as to yard location in blocks "25," "26," and "27" of the TCMD. After the cargo

checker has signed the TCMDs, they are filed in a TCMD marshalling yard file until the container is ready to be cleared from the yard, or is relocated in the yard. When the container is relocated, the new location is entered in the TCMD.

CONTAINER STUFFING/STRIPPING

Container stuffing/stripping is accomplished primarily at the consignee/consignor area. It will be necessary, however, to perform some stuffing/stripping service at the water terminal (marshalling area).

STEP 1.

The cargo checker at the stuffing/stripping location receives a container content discharge tally list, a TCMD for the container, and TCMD's for all cargo in the container. The container content discharge tally list is annotated in the following columns.

Serial Page Number — Enter the page number from the block in the upper right corner of each TCMD for each TCN or shipment unit.

Pier Location — Enter breakbulk point (BBP) yard location.

Time — Enter the time the container is stripped.

Tally Date — Enter the Julian date.

Piece Count — Enter a stroke tally (for example, IIII) to verify the number in the **MAN PCS** (manifested pieces) column of the tally list.

STEP 2.

Any discrepancies between the manifested pieces and the actual pieces in the container are noted by a pen and ink change to the tally list so that the tally shows the actual number of pieces received.

STEP 3.

The TCMDs are annotated with the following data elements.

Block "25a" — Enter "BBP."

Block "25b" — Enter date cargo received at BBP.

Block "25c" — Enter BBP warehouse or yard location of the cargo after it is staged.

STEP 4.

When clearance transport arrives to pick up cargo from the BBP, the checker makes the following entries on the TCMD.

Block "29" — Enter day shipped (day cargo released to consignee).

Block "30" — Optional use.

Block "31" — Get signature of individual receiving the cargo (and any optional remarks) and pull a copy of the TCMD for the documentation element.

STEP 5.

At the completion of each shift, all cargo checkers from that shift meet with the chief cargo checker to compare tally lists and to reconcile any discrepancies (for example, between tally sheet and physical count). Based on data derived from the tally lists, the chief cargo checker then prepares a consolidated discharge list which he turns in together with TCMDs to the documentation section.

SUMMARY

In this chapter we have talked about our "paper tools." As you have seen, the addresses identify the shipments and keep them moving. The special handling labels help us keep down cargo damage. They also help protect the cargo handlers. You just don't want to drop a box marked poison gas. Besides these markings, we discussed the documentation which helps us account for what we are handling.

This paperwork may seem unimportant when compared with the large equipment used to load and unload the ship. Nonetheless, without these paper tools the transportation system would be like a ship without a rudder, or an engine out of oil. Sometimes it's the little things that count.



1

2

3

4

5



6

7

8

9

10

11

12



CHAPTER 10 SAFETY IN TERMINAL OPERATIONS

Safety is the responsibility of each and every person working in a terminal. As a supervisor you have the responsibility of making sure that personnel working under your supervision are performing their duties in safe areas.

VESSEL ACCESS

GANGWAYS



A gangway is any ramp or stairway that is used to board or leave a vessel. Personnel should not be permitted to board or leave any vessel until the following conditions are met.

The gangway used must be at least 20 inches wide, strong, securely fastened, and safely maintained.

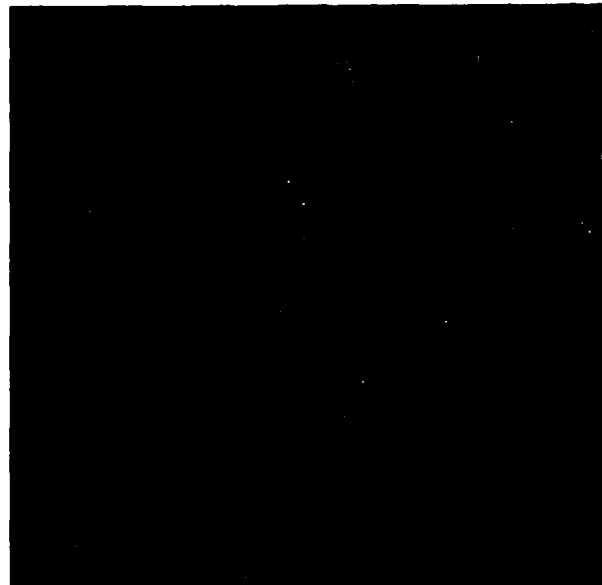
During the hours of darkness, the gangway should be lighted to keep personnel from tripping over steps or stumbling on floor ridges.

Obstructions such as support bridles, dunnage, or ropes should be kept clear of the gangway so they will not block passage or cause personnel to stumble.

When the end of the gangway overhangs the water between the ship and the pier, a net or other suitable protection should be rigged at the foot of the gangway to prevent personnel from falling into the water.

When the top of the gangway rests on or is flush with the top of the bulwark, install steps between the bulwark and the deck. Equip the steps with a hand rail at least 33 inches high.

If the foot of the gangway is more than one foot away from the edge of the pier (apron), a walkway equipped with 33-inch-high railings should be used to bridge the gap.



The distance from the weather deck to the pier rises and falls with the tide, or as the ship is loaded or discharged. Most gangways used today have rollers on the bottom which automatically adjust to this change. But some gangways must

be either raised or lowered to adjust to the change. In these cases, someone aboard must be assigned to periodically check the gangway to make sure that it is properly adjusted.

STRAIGHT LADDERS

There should be at least one accessible ladder for each gang working in a hatch. In cases where the coaming or other structural features can't be used to gain a handhold at the top of the ladder, provide other means at the head of the ladder to serve this purpose.

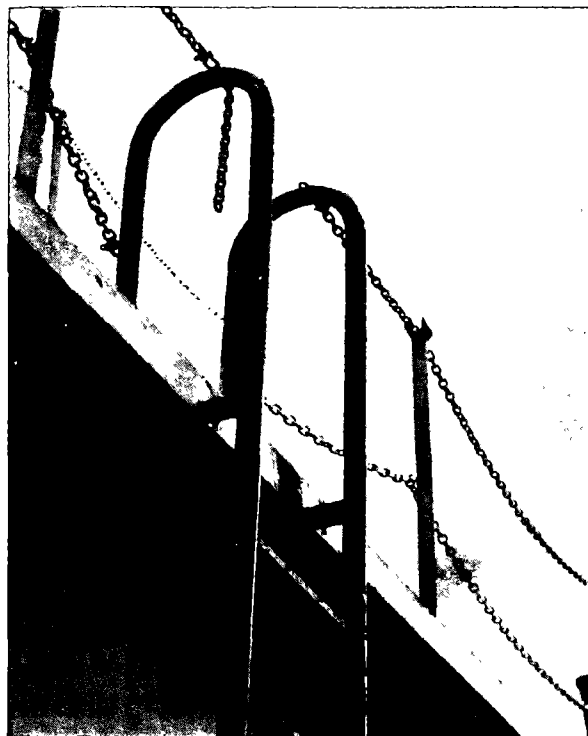
When any fixed ladder is visually unsafe, do not permit personnel to use it.

When there is not 4 inches of clearance at the back of the ladder rungs, the ladder is unsafe.

When using straight ladders, make sure that they are of adequate strength, and long enough to extend at least 36 inches above the coaming. They must be properly secured against shifting or slipping.

Should the angle of a ladder become so great that it requires personnel to walk on the edges of the treads, boards with cleats should be laid on top of the ladder and secured.

When it is necessary to reach stowed deckload or other cargo and no other safe means is available, use ladders or steps that are strong enough and that are properly secured. Steps formed by

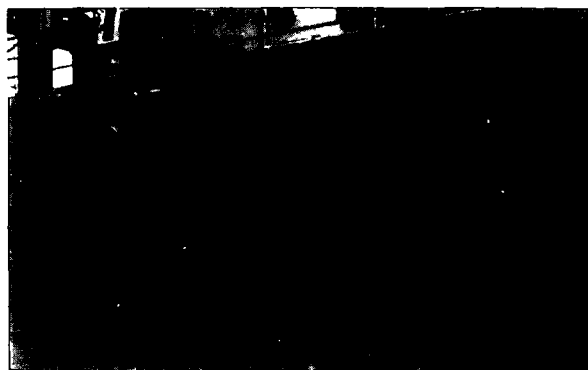


the cargo itself are acceptable when the nature of the cargo and the type of stowage permits.

JACOB'S LADDERS

When conditions are such that neither a gangway nor a straight ladder can be used, use a Jacob's ladder. Jacob's ladders are of the double ring or flat tread type. They must be well maintained and properly secured. A Jacob's ladder has to hang without slack from its lashing or be pulled up entirely.

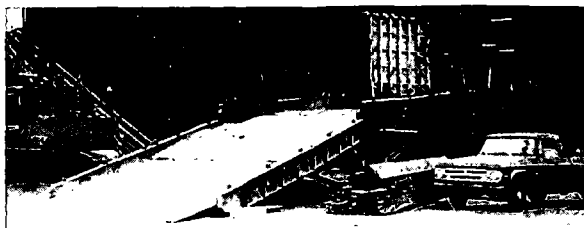
When a barge, raft or log boom is being worked alongside a larger vessel, use a Jacob's ladder for each gang working alongside unless other safe means of access are provided.



BRIDGE PLATES AND RAMPS

Bridge or car plates used afloat must be strong, equipped with side boards along the space bridged, well maintained, and secured to prevent movement.

Ramps for access of vehicles to or between vessels must be strong, provided with side boards, well maintained, and properly secured.



OPENING AND CLOSING HATCHES

COAMING CLEARANCE

Weather Deck. Be careful when bundles of lumber or other smooth-sided deck cargo over 5 feet high is stowed within 3 feet of the hatch coaming. Be especially careful when the personnel handling the beams and hatch covers are not protected by at least a 24-inch clearing from the coaming. In this case, provide a tautline along the side of the deckload for their protection.

Intermediate Deck. Before intermediate deck hatch covers and beams are removed or replaced by personnel, be sure there is a 3-foot working space in the following places:

- Between the stowed cargo and the coaming at both sides.
- At one end of all hatches having athwartship beams.
- At both ends of those hatches with fore and aft beams.

Exceptions to the above may be made when a

3-foot working space is not required on the covered portion of a partially opened hatch. Also, it is not required when lower decks have been filled to beam height with cargo that provides a safe surface upon which personnel can work.

Banana or other fitted gratings are considered a part of the decking when properly placed within the 3-foot area.

When bulkheads, lockers, reefer compartments, or large spare parts are within 3 feet of the coaming, provide grab rails or taut handlines for the protection of the personnel handling beams and hatch covers.

These rules covering coaming clearance do not apply to hatches that are opened by hydraulic or other mechanical means. In all cases where the 3-foot clearance does not exist, take means to prevent stowed cargo from shifting and falling into the hold.

BEAM AND PONTOON BRIDLES

Do not use beam and pontoon bridles unless they meet the following requirements.

Bridles must be long enough to easily reach the holes, rings, or other lifting attachments on the beams and pontoons. The bridles must be of the right strength, and must have been properly taken care of.

Bridles for lifting hatch beams must be equipped with toggles, shackles, hooks, or other

devices to keep them from being accidentally moved from the beams. Hooks may be used only when they are hooked into the standing part of the bridle. Toggles must be at least 1 inch longer than twice the longest diameter of the holes into which they are placed.

Bridles used for lifting pontoons and plugs must have the number of legs required by the design of the pontoon or plug used. All the legs

must be used. In cases where the use of a bridle requires less than the number of legs provided, idle legs should be hung on the hook or ring or prevented from swinging free.

At least 2 legs of all strongback and pontoon bridles must be equipped with a fiber rope lanyard at least 8 feet long in good condition. The bridle end of the lanyard may be of chain or wire.

HANDLING BEAMS AND COVERS

When hatch covers or pontoons are stowed on the weather deck level with the hatches, stack them not closer than 3 feet from the hatch coaming on the nonworking side of the deck. When on the working side of the deck, stack them not higher than the coaming. An exception to this is if they are spread one high between coaming and rail with no space between them. Keep a minimum of 24-inch height of hatch coaming.

When these requirements cannot be met due to the narrowness of the available deck area, pontoons may be stowed more than one high against the coaming. This is provided so that at least a 24-inch height of hatch coaming is kept on the working side of the vessel. If pontoons are stowed closer than 3 feet to and higher than the coaming on the nonworking side, secure them to prevent movement.

When some of the small weather deck hatch boards or similar covers on seagoing vessels are removed from the beams for handling, cleaning, or other operations, do not stow those removed on those left in place.

Lay beams on their sides, or stand them on edge close together and lashed. This does not apply when:

- The width of the flange of the beam is 50 percent or more of the height of the web.
- The flange of the beam rests flat on the deck when the beam is stood upright.

Place strongback hatch covers and pontoons so as not to interfere with a safe walkway on all

sides of the hatch. Secure them so they cannot be tipped over or dragged into hatches or overboard by drafts of cargo or ships gear. Use dunnage or other suitable material under and between tiers of strongbacks and pontoons. Place unshipped strongbacks in an intermediate deck no closer than 6 inches to the coaming. If placed closer than 3 feet, secure them so that they cannot be tipped or dragged into a lower compartment. If this is not possible, move them to another deck.

Lash, lock, and secure any beam or pontoon left in place adjacent to a section through which cargo, dunnage, equipment, or any other material is being worked. This is to prevent it from being moved accidentally. Remove all portable, manually handled hatch covers. This includes those bound together to make a larger cover from any working section.

The roller hatch beam at the edge of the open section of the hatch must be lashed or pinned back so that it cannot be moved toward the open section.

Secure all sectional or telescopic hatch covers of barges which open in a fore and aft direction against movement while they are in an open position.

When a hatch is to be covered, use hatch covers or night tents. Do not cover any partial hatch covering, such as alternate hatch covers or strips of dunnage, with a tarpaulin. Secure all hinged or folding hatch covers when in an upright position. Do not open or close hatches while workers are in the square of the hatch below.

VESSEL WORKING SURFACE

HATCH COVERING

Do not load or unload cargo, dunnage, or other material at any partially opened intermediate

deck unless the hatch at that deck is sufficiently covered.

Do not handle or land cargo on or over a covered hatch or 'tween deck unless all beams are in place under the hatch covers.

Report to the hatch foreman all missing, broken, split, or poorly fitted hatch covers that would jeopardize the safety of personnel. Do not work in a section containing unsafe covers or in adja-

cent sections unless the flooring is made safe. When the hatch covers or beams are not of uniform size, place them only in the hatch, deck, or section in which they fit properly.

Cover and guard the small trimming hatches located in intermediate decks while working in the hatch in which they are located.

STOWED CARGO AND TEMPORARY LANDING PLATFORMS

Make sure that temporary tables on which loads are to be landed are large enough and strong enough to permit personnel to work in safety.

When the edge of a hatch section is more than 8 feet higher than stowed cargo, it presents a dan-

ger of personnel falling in. Guard the edge with a safety net.

In addition, when two gangs are working in the same hatch on different levels, rig a safety net and securely fasten it so as to prevent men or cargo from falling.

DECK LOADS

Do not pass fore and aft, over or around deck loads, unless there is a safe passage.

Do not permit signalmen to walk over deck loads from rail to coaming unless there is a safe passage.

If it is necessary to stand at the outboard or inboard edge of the deckload where less than 24 inches of bulwark, rail, coaming, or other protection exists, provide some means of protection against falling from the deckload.

SKELETON DECKS AND WEATHER DECK RAILS

Cargo must not be worked on a skeleton deck, mechanical deck, or other superstructure unless temporary flooring is provided. This is to make a safe working surface.

Keep removable weather deck rails in place except when cargo operations require their removal. If they have to be removed or replaced, do it as soon as cargo operations are completed.

OPEN HATCHES

All open weather hatches not protected by 24 inches of coaming must be guarded to protect working personnel. Use tautlines to guard these at a height of 36 to 42 inches above the deck ex-

cept on the side on which cargo is being worked. Secure portable stanchions or uprights to prevent accidental moving.

BARGES

Do not permit personnel to walk along the sides of covered lighters or barges with coamings more than 5 feet high unless there is a 3-foot clear walkway, grab rail, or taut handline provided.

Personnel must not be allowed to walk or work on the decks of barges to be loaded unless the

walking or working surfaces have been determined by visual inspection to be safe and sound. If in the course of discharging a barge, an unsound deck surface is discovered, stop work and do not resume until temporary means to insure a safe working surface is made.

FRESHLY PAINTED OR OILED DECKS

If decks are wet with fresh paint or oil, do not permit personnel to engage in operations until necessary walking and working areas have

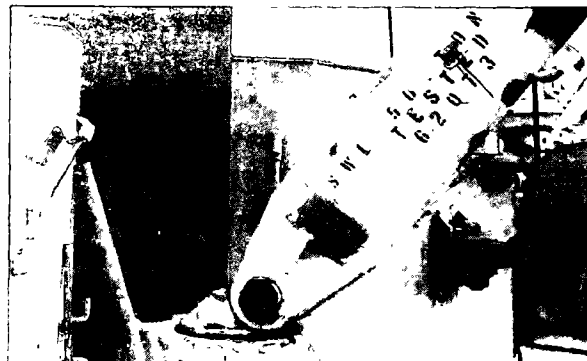
been made safe by the use of suitable nonskid materials.

SHIP'S GEAR

CERTIFICATION AND LIMITATION REQUIREMENTS

Before using gear, make sure that it has a current and valid registration and certificate. These certificates indicate that the cargo gear has been tested, examined, and heat-treated by or under the supervision of persons or organizations defined as competent to make register entries and issue certificates.

Do not exceed the safe working load as specified in the cargo gear certification papers, nor the safe working load marked on the booms. Do not use any unsafe rigging gear.



EQUIPMENT HANDLING REQUIREMENTS

The specific safety guidelines in using ship's gear are as follows.

STOPPERS

Make sure that chain topping lift stoppers are in good condition, equipped with manila tails, and long enough to allow not fewer than three half-hitches in the chain.

Secure chain stoppers in such a manner that their links are not bent by being passed around fittings. The point of attachment must be strong and located so that the stopper is in line with the normal topping lift lead at the time the stopper is used.

Patent stoppers of the clamp type are suited to the size of the rope used. Maintain clamps in good condition and free of paint and dirt which would prevent their being drawn tight.

FALLS

The end of the winch fall is secured to the drum by clamps, U-bolts, shackles, or some other

equally strong method. Do not use fiber rope fastenings.

Winch falls are not to be used with fewer than three turns on the winch drum.

Eyes in the ends of wire rope on cargo falls are not to be formed by knots. In single part falls, they are not formed by wire rope clips.

When the design of the winch permits, the fall is wound on the drum so that the control mechanism moves in the same direction as the load.

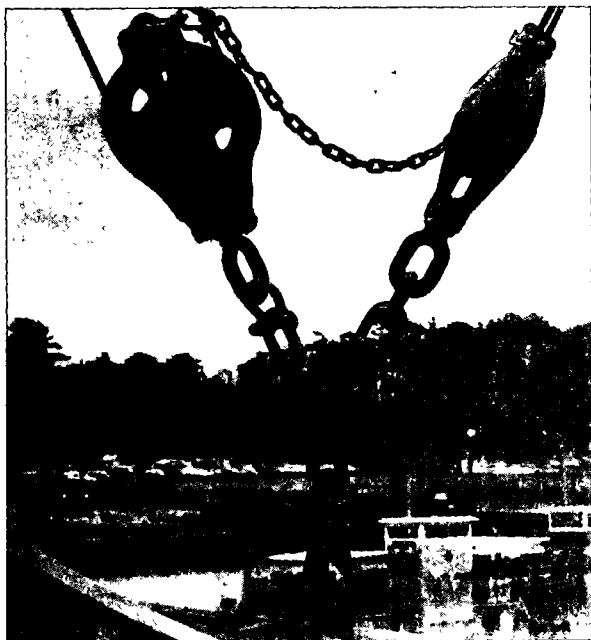
When you are required to work in the bight formed by the heel block, rig a preventer of at least $\frac{3}{4}$ -inch diameter wire rope, wound reasonably snug and secure. This is to hold the block and fall in case the heel block attachments fail. When conditions do not allow for the fitting of a wire rope preventer of the required size, the maximum possible protection must be provided.

If the heel block is not being used, secure it so that it remains in its normal operating position. However, this does not apply when the heel block is located at least 10 feet above the deck when at its lowest point.

COAMING ROLLERS

Portable coaming rollers are secured by wire preventers in addition to the regular coaming clamps.

CARGO HOOKS



Place cargo hooks as close to the junction of the falls as the assembly permits. In no case should they be farther than 2 feet from it. This does not apply when the construction of the vessel and the operation in progress are such that fall angles in excess of 120 degrees do not normally occur. Overhaul chains are not to be shortened by bolting or knotting.

CARGO WINCHES

When moving parts of winches or other deck machinery present a hazard, guard them to prevent an accident.

Except for short handles on wheel-type controls, do not permit winch operators to use winch control extension levers. An exception is if they are provided by either the ship or the owner. Such levers must be strong and securely fastened with metal connections at the fulcrum and at the permanent control lever.

Winches are not to be used if control levers operate with excessive friction or play.

Double gear winches or other winches equipped with a clutch are not to be used unless a positive means of locking the gear shift is provided.

When changing gears on a two-gear winch, there is to be no load other than the fall and cargo hook assembly on the winch.

Report immediately any defect or malfunction of winches to the officer in charge of the vessel.

Temporary seats and shelters for winch operators which create a hazard to the winchmen or other workers are not to be used.

ELECTRIC WINCHES

When the electromagnetic or other service brake is unable to hold the load, the winch is not to be used.

Winches are not to be used when one or more control points, either hoisting or lowering, is not operating properly. Do not allow personnel to tamper with or adjust electric control circuits.

When winches are left unattended, the power is to be shut off or control levers locked at the winch or the operating control.

RIGGING GEAR

When alternative positions for securing guys are provided, the guys are to be placed so as to produce a minimum stress without permitting the boom to jackknife.

The head of the amidship boom is spotted no farther outboard of the coaming than is necessary for control of the load.

The following procedures should be observed when rigging or using preventers.

Preventers are to be properly secured to suitable fittings other than those to which the guys are secured. They are to be as nearly parallel to the guys as available fittings permit.

The leads of preventers to cleats are to be such that the direction of the line pull of the preventer

is parallel to the plane of the surface on which the cleat is mounted. This applies unless the cleat is also a chock and the hauling part is led through the chock opening.

Guys and associated preventers are to be adjusted to share the load equally where cargo operations are being conducted by burtoning. Leave the guy slack where guys are made and intended for trimming purposes only, and where the preventer is intended to perform the function of the guy.

The following safety precautions should be observed when operating cargo booms.

Do not run cargo runners across the hatch coaming.

Do not handle drafts that exceed the safe working load of the rigging.

Continually check all rigging during cargo operations. This is the responsibility of the hatch foreman and deck men.

Since the weight on a topping life increases as a boom is lowered, instruct deck crews to take enough turns on a cleat or cathead while the boom is high. This is to insure having control of it when it reaches a low position.

Exercise particular care to avoid overloading or putting shock loads on the cargo gear when the boom is at a low angle.

Keep tension on married falls as low as possible during a lift to avoid excessive tension on the guys.

Use slings as short as cargo permits, and keep the hook as close to the junction of the falls as possible.

Avoid letting a loaded boom rest against a stay, shroud, or other fixed object, as the resultant bending may cause the boom to fail.

Inspect booms before starting work, and use any that are visibly bent with extreme caution because of their weakened condition. Before applying power to a guy, be sure that the gooseneck is free to turn by heaving on the guy by hand.

Keep the loads as close to the rail, deck, and coaming (as low) as possible.

Avoid severe tightening of even very light loads. This is because a difference of only a foot or two in the height of the load may increase the stress tremendously.

Keep the heads of the two booms as close together and as high as possible to reduce the tension on the falls and therefore the guys. This is effective at any given height in the junction of married falls.

When the amidship boom angles inboard from its heel, place the guy at right angles to the boom, as seen by looking up from on deck.

When the amidship boom is fore and aft, place the guy at a right angle to the boom when minimum tension is desired.

When the boom angles outboard from its heel, place the guy abreast the heel or as far behind it as possible without permitting the boom to jack-knife.

Cargo falls under load should not be permitted to chafe on any standing or other running rigging.

Where a bull wire is taken to a gypsy head for the purpose of lowering or topping a boom, the bull wire is secured to the gypsy head by shackle or other equally strong method. Securing it by fiber rope fastening is not considered sufficient.

When, in lowering or topping a boom, it is not possible to secure the bull wire to the gypsy head, or when the topping lift itself is taken to the gypsy head, enough turns (in no case less than five) are to be used.

GEAR AND EQUIPMENT OTHER THAN SHIP'S GEAR

All gear and equipment is to be inspected before use. Inspections are also to be made at intervals during its use to make sure that it is safe.

Any gear that is found upon such inspection to be visibly unsafe is not to be used until it is made safe.

All special cargo handling gear, such as shackles, ropes, or chain, is to be tested as a unit before initially being put into use. The weight must be

plainly marked on any article of cargo handling gear hoisted by ship's gear and weighing in excess of 2,000 pounds.

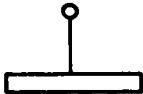
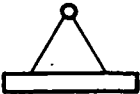
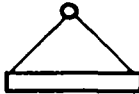
FIBER ROPE AND FIBER ROPE SLINGS

Use the following table on fiber ropes to determine the safe working load of various sizes of manila rope and rope slings at various angles.

Exceptions to these safe working loads are allowed for certain items when recommended by the manufacturer.

MANILA ROPE

(In pounds or tons of 2000 pounds)

Circumference (inches)	Diameter (inches)	Single Leg	60°	45°	30°
					
3/4	1/4	120 lbs	240 lbs	170 lbs	120 lbs
1	5/16	200	346	282	200
1 1/6	3/8	270	467	380	270
1 1/4	7/16	350	605	493	350
1 3/6	15/32	450	775	635	450
1 1/2	1/2	530	915	798	530
1 3/4	9/16	690	1190	973	690
2	5/8	880	1520	1240	880
2 1/4	3/4	1080	1870	1520	1080
2 1/2	13/16	1300	2250	1830	1300
2 3/4	7/8	1540	2660	2170	1540
3	1	1800	3120	2540	1800
3 1/4	1 1/16	1.0 tons	1.7 tons	1.4 tons	1.0 tons
3 1/2	1 1/8	1.2	2.1	1.7	1.2
3 3/4	1 1/4	1.35	2.3	1.9	1.35
4	1 5/16	1.5	2.6	2.1	1.5
4 1/2	1 1/2	1.8	3.1	2.5	1.8
5	1 5/8	2.25	3.9	3.2	2.25
5 1/2	1 3/4	2.6	4.5	3.7	2.6
6	2	3.1	5.4	4.4	3.1
6 1/2	2 1/8	3.6	6.2	5.1	3.6

When synthetic fiber ropes are substituted for manila ropes of less than 3-inch circumference, the substitutes are to be of equal size. Where synthetic fiber ropes are substituted for manila ropes of 3-inch circumference or more, the size of the synthetic rope is to be determined from the formula:

$$C = 0.6C_s + 0.4C_m$$

Where: C = The required circumference of the synthetic rope in inches.

C_s = The circumference to the nearest one-quarter inch of a synthetic rope having a breaking strength not less than the breaking strength of the size manila rope that would be required by this section.

C_m = The circumference in inches of manila rope that would be required by this section.

WIRE ROPE AND WIRE ROPE SLINGS

Use the following tables on wire rope and wire rope slings to determine the safe working loads of various sizes and classifications. For sizes, classifications and grades not included in these tables use the safe working load recommended by the manufacturer.

Do not cover protruding ends of strands in splices on slings and bridles.

Where "U" bolt wire rope clips are used to form eyes, use the table to the right to determine the number and spacing of clips. Apply the "U" bolt so that the "U" section is in contact with the dead end of the rope. Never secure wire rope by knots except on haul back lines on scrapers.

U-BOLT WIRE ROPE CLIPS

Improved plow steel, rope (diameter inches)	Number of clips		Minimum spacing (inches)
	Drop forged	Other material	
*			
1/2	3	4	3
5/8	3	4	3 3/4
3/4	4	5	4 1/2
7/8	4	5	5 1/4
1	4	6	6
1 1/8	5	6	6 3/4
1 1/4	5	7	7 1/2
1 3/8	6	7	8 1/4
1 1/2	6	8	9

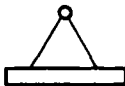
*Three clips shall be used on wire size less than 1/2-inch diameter.

INDEPENDENT WIRE ROPE CORE, WIRE ROPE AND WIRE ROPE SLINGS

(In tons of 2000 pounds)

Rope Diameter (inches)	SINGLE LEG					
	Vertical			Choker		
	A	B	C	A	B	C
6 x 19 CLASSIFICATION						
1/4	0.59	0.56	0.53	0.44	0.42	0.40
3/8	1.3	1.2	1.1	0.98	0.93	0.86
1/2	2.3	2.2	2.0	1.7	1.6	1.5
5/8	3.6	3.4	3.0	2.7	2.5	2.2
3/4	5.1	4.9	4.2	3.8	3.6	3.1
7/8	6.9	6.6	5.5	5.2	4.9	4.1
1	9.0	8.5	7.2	6.7	6.4	5.4
1 1/8	11.0	10.0	9.0	8.5	7.8	6.8
6 x 37 CLASSIFICATION						
1 1/4	13.0	12.0	10.0	9.9	9.2	7.9
1 3/8	16.0	15.0	13.0	12.0	11.0	9.6
1 1/2	19.0	17.0	15.0	14.0	13.0	11.0
1 3/4	26.0	24.0	20.0	19.0	18.0	15.0
2	33.0	30.0	26.0	25.0	23.0	20.0
2 1/4	41.0	38.0	33.0	31.0	29.0	25.0
(A)—Socket or Swaged Terminal attachment. (B)—Mechanical Sleeve attachment. (C)—Hand Tucked Splice attachment.						

WIRE ROPE SLINGS (In tons of 2000 pounds)

TWO-LEG BRIDLE OR BASKET HITCH												
Rope Diameter (inches)	Vertical			60° 			45° 			30° 		
	A	B	C	A	B	C	A	B	C	A	B	C
6 x 19 CLASSIFICATION												
1/4	1.1	1.0	0.99	0.95	0.88	0.85	0.77	0.79	0.70	0.55	0.51	0.49
3/8	2.4	2.2	2.1	2.1	1.9	1.8	1.7	1.6	1.5	1.2	1.1	1.1
1/2	4.3	3.9	3.7	3.7	3.4	3.2	3.0	2.8	2.6	2.1	2.0	1.8
5/8	6.7	6.2	5.6	5.8	5.3	4.8	4.7	4.4	4.0	3.3	3.1	2.8
3/4	9.5	8.8	7.8	8.2	7.6	6.8	6.7	6.2	5.5	4.8	4.4	3.9
7/8	13.0	12.0	10.0	11.0	10.0	8.9	9.1	8.4	7.3	6.4	5.9	5.1
1	17.0	15.0	13.0	14.0	13.0	11.0	12.0	11.0	9.4	8.4	7.7	6.7
1 1/8	21.0	19.0	17.0	18.0	16.0	14.0	15.0	13.0	12.0	10.0	9.5	8.4
6 x 37 CLASSIFICATION												
1 1/4	25.0	22.0	20.0	21.0	19.0	17.0	17.0	16.0	14.0	12.0	11.0	9.8
1 3/8	30.0	27.0	24.0	26.0	23.0	20.0	21.0	19.0	17.0	15.0	13.0	12.0
1 1/2	35.0	32.0	28.0	30.0	27.0	24.0	25.0	22.0	20.0	17.0	16.0	14.0
1 3/4	48.0	43.0	38.0	41.0	37.0	33.0	34.0	30.0	27.0	24.0	21.0	19.0
2	62.0	55.0	49.0	53.0	48.0	43.0	43.0	39.0	35.0	31.0	28.0	25.0
(A)—Socket or Swaged Terminal attachment. (B)—Mechanical Sleeve attachment. (C)—Hand Tucked Splice attachment.												

The following limitations apply to the use of wire rope.

An eyesplice made in any wire rope must have not less than three full tucks. However, do not use this in place of another form of splice or connection which is safe to use.

Except for eye splices in the ends of wires and for endless rope slings, each wire rope used in hoisting or lowering, or in bulking cargo, must

consist of one continuous piece without knot or splice. Eyes in wire rope bridles, slings, or bull wires are not to be formed by wire rope clips or knots.

Wire rope is not to be used as cargo handling gear if, in any length of eight turns, the total number of visible broken wires exceeds ten percent of the total number of wires. Also, it is not used if the rope shows other signs of excessive wear, corrosion, or defect.

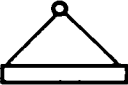
CHAIN AND CHAIN SLINGS

Use the following table on chains and chain slings to determine the maximum safe working loads of various sizes of wrought iron and alloy

steel chains and chain slings. Higher safe working loads are allowed when recommended by the manufacturer. Proof coil steel chain, also known

WROUGHT IRON CHAIN

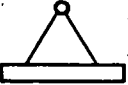
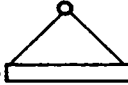
(In pounds or tons of 2000 pounds)

Nominal Size Chain Stock (inches)	Single Leg	60°	45°	30°
				
* 1/4	1060 lbs	1835 lbs	1500 lbs	1060 lbs
* 5/16	1655	2865	2340	1655
3/8	2385	2.1 tons	3370	2385
* 7/16	3250	2.8	2.3 tons	3250
1/2	2.1 tons	3.7	3.0	2.1 tons
* 9/16	2.7	4.6	3.8	2.7
5/8	3.3	5.7	4.7	3.3
3/4	4.8	8.3	6.7	4.8
7/8	6.5	11.2	9.2	6.5
1	8.5	14.7	12.0	8.5
1 1/8	10.0	17.3	14.2	10.0
1 1/4	12.4	21.4	17.5	12.4
1 3/8	15.0	25.9	21.1	15.0
1 1/2	17.8	30.8	25.2	17.8
1 5/8	20.9	36.2	29.5	20.9
1 3/4	24.2	42.0	34.3	24.2
1 7/8	27.6	47.9	39.1	27.6
2	31.6	54.8	44.8	31.6

*These sizes of wrought iron chain are no longer manufactured in the United States.

ALLOY STEEL CHAIN

(In tons of 2000 pounds)

Nominal Size Chain Stock (inches)	Single Leg	60°	45°	30°
				
1/4	1.62	2.82	2.27	1.62
3/8	3.30	5.70	4.65	3.30
1/2	5.62	9.75	7.90	5.62
5/8	8.25	14.25	11.65	8.25
3/4	11.5	19.9	16.2	11.5
7/8	14.3	24.9	20.3	14.3
1	19.3	33.6	27.3	19.8
1 1/8	22.2	38.5	31.5	22.2
1 1/4	28.7	49.7	40.5	28.7
1 3/8	33.5	58.0	47.0	33.5
1 1/2	39.7	68.5	56.0	39.7
1 5/8	42.5	73.5	59.5	42.5
1 3/4	47.0	81.5	62.0	47.0

as common or hardware chain, or other chain not recommended for slinging or hoisting by the manufacturer, is not to be used for hoisting purposes.

All sling chains, including end fastenings, must be given a visual inspection before being used on the job. A thorough inspection includes inspecting for wear, defective welds, deformation, and increase in length of stretch.

Interlink wear, not accompanied by stretch in excess of 5 percent, is to be noted. The chain is to be removed from service when maximum allowable wear at any point of the link, as indicated in the table, has been reached.

Chain slings are to be removed from service if any section shows a measured increase in length greater than 5 percent, or if raised scarfs or defective welds appear.

All repairs to chains are to be made under qualified supervision. Links or portions of a chain found to be defective must be replaced by links having proper dimensions. Replacement links must be made of material similar to that of the rest of the chain. Before repaired chains are returned to service, they must be proof tested to the proof test load recommended by the manufacturer.

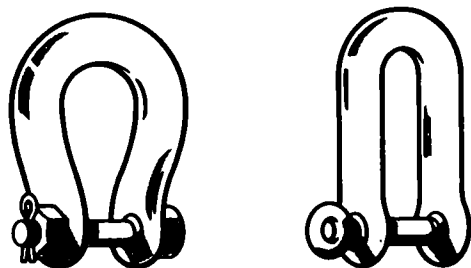
Wrought iron chains in constant use are strengthened or normalized at intervals not exceeding 6 months with recommended procedures for annealing or normalizing. Alloy chains are not to be tempered.

A load is not to be lifted with a chain having a kink or knot in it. Do not shorten any chain by bolting, wiring, or knotting.

SHACKLES

Use the table on the right to determine the safe working loads of various sizes of shackles. Higher safe working loads are allowed when recommended by the manufacturer.

Screw pin shackles are to have their pins moused. This is true except in cargo hook assemblies.



SAFE WORKING LOADS FOR SHACKLES
(In tons of 2000 pounds)

Material size (inches)	Pin diameter (inches)	Safe working load
1/2	5/8	1.4
5/8	3/4	2.2
3/4	7/8	3.2
7/8	1	4.3
1	1 1/8	5.6
1 1/8	1 1/4	6.7
1 1/4	1 3/8	8.2
1 3/8	1 1/2	10.0
1 1/2	1 5/8	11.9
1 3/4	2	16.2
2	2 1/4	21.2

HOOKS OTHER THAN HAND HOOKS

Use manufacturer's recommendations to determine the safe working loads of specific and identifiable hooks. Hooks for which no applicable manufacturer's recommendations are available must be tested before being used. The owner/shipper should maintain a record of the dates and results of such tests.

Apply loads to the throat of the hook, since

loading the point overstresses and bends or springs the hook. Inspect hooks regularly to see that they have not been bent by overloading. Do not use bent or sprung hooks.

The teeth of case hooks are to be kept in good condition. Keep the jaws of patent clamp-type plate hooks in safe condition so that they will grip the plates securely.

PALLETS

Pallets should be of such material and construction and should be maintained so as to safely support and carry loads being handled on them. Fastenings of reusable pallets are bolts and nuts, drive screws, annular threaded nails or fastenings of equal strength.

Wing or lip-type pallets hoisted by means of bar bridles must have an overhanging wing or lip

at least 3 inches long. Loaded pallets which are found to be damaged or otherwise unsafe should be placed on good pallets before being hoisted on or off the vessel.

Bridles used to handle flush end or box-type pallets should be made in such a manner as to prevent them from coming loose from the pallet under load.

CHUTES, GRAVITY CONVEYORS, AND ROLLERS

Chutes used in the manual handling of cargo must be long enough and strong enough for the use to which they are put. Chutes must be kept free of splinters and sharp edges which could stop or damage cargo. Also, make sure that sideboards are tall enough to prevent cargo from falling off.

Chutes and gravity roller sections must be firmly placed or secured to prevent movement.

Gravity rollers should be strong enough to withstand the weight of the materials placed on them. Lock rollers in position to prevent them from falling or jumping out of the frame. Keep roller frames free of burrs and sharp edges.

It is sometimes necessary to find a way to brake objects at the delivery end of the roller or chute.

POWERED CONVEYORS

Readily accessible "stop" controls are provided for use in an emergency. DO NOT allow anyone

to work around a power conveyor unless an operator is on duty at the conveyor controls.

RAIN TENTS

When using rain tents, secure lanyards to pad eyes or other fixed structures of the vessel which are strong enough to hold them, or secure them

to objects which are heavy enough to withstand the breaking stress of all lanyards attached.

TOOLS

The following precautions should be observed regarding the use of tools.

Tools which are visibly unsafe should not be used for any purpose.

Portable electric tools which are held in the hand must be equipped with switches of the type that are manually held in a closed position.

All portable, power-driven circular saws must be equipped with guards above and below the base plate or shoe. The upper guard should cover the saw to the depth of the teeth, except for the

minimum arc required to permit the base to be tilted for level cuts. The lower guard should cover the saw to the depth of the teeth, except for the minimum arc required to allow proper retraction and contact with the work. When the tool is withdrawn from the work, the lower guard should automatically and instantly return to the covering position.

The officer in charge of the operation must notify the ship's master before using the ship's electric power for the operation of any of his electric tools and equipment.

The frames of portable electric equipment and tools, except double-insulated tools approved by Underwriter's Laboratories, Inc., must be grounded through a separate wire which is grounded at the source of the current.

MECHANICALLY POWERED VEHICLES

Make sure that all automotive equipment is maintained in good working order, and that safety devices are not removed or made inoperative.

Except as noted below, forklift trucks should be equipped with overhead guards securely attached to the machines. The guards protect the operator from boxes, cartons, packages, bagged material, and other similar items of cargo which may fall from the load being handled or from stowage.

The guards should not interfere with good visibility. Openings in the top of the guard should not exceed 6 inches in one of the two dimensions, width or length. Larger openings are permitted provided no opening is larger than the smallest unit of cargo that is likely to fall on the guard.

The guards should be large enough to extend over the operator in all normal circumstances of truck operation including forward tilt.

In forklift trucks equipped with a single tilt cylinder, associated parts should not cause the overhead guard to injure the operator.

The overhead guard may be removed only at times when the construction of the truck is such that the presence of such a guard would prevent the truck from entering working spaces, or if the operator cannot be injured by low overhead obstructions.

Every crawler-type, rider-operated, bulk cargo-moving vehicle must be equipped with an operator's guard that protects the operator, when seated, against injury from contact with a projection overhead. Guards and their attachment points must be made so as to be able to withstand a load applied horizontally at the operator's shoulder level equal to the drawbar pull of the machine.

Circuits grounded other than by means of the structure of the vessel on which the equipment is being used must be checked to insure that the circuit between the ground and the grounded power conductor is of low resistance.

Guards may not be required when the vehicle is used in situations in which the possibility of the seated operator coming in contact with projecting overheads does not exist.

Every truck operated from an end platform or pedal position must be equipped with an operator's platform guard of such design that it permits rapid and unobstructed exit.

Guards must be able to withstand without excessive deflection a load equal to the weight of the loaded machine.

Forks, fork extensions, or other attachments must be secured to prevent them from accidentally being detached.

The vehicle weight, with and without removable counterweights, must be clearly posted on all mechanically-powered vehicles which are lifted aboard vessels.

The rated capacity of every forklift truck, with and without removable counterweights, must be posted on the vehicle in such a manner as to be readily visible to the operator.

Loads in excess of the rated capacity must not be lifted or carried by forklift trucks. If loads are lifted by two or more trucks working in unison, the total weight must not exceed the combined safe lifting capacity of all the trucks.

No load on a forklift truck or industrial crane truck may be suspended or swung over any personnel.

When mechanically-powered vehicles are used, adequate provisions must be made to insure that the working surface can support the vehicle and load, and that hatch covers, truck plates, or other temporary surfaces cannot be broken loose by movement of the vehicle.

When mechanically-powered vehicles are left unattended, the controls must be shut off, brakes set, and the forks, blade, or scoop must be placed in the lowered position.

When forklift trucks or other mechanically-powered vehicles are being operated on open-deck-type barges, the edges of the barges must be

guarded by railings, sideboards, timbers, or other means that are able to prevent vehicles from rolling overboard. When operated on covered lighters where door openings other than those being used are left open, means must be taken, as necessary, to prevent vehicles from rolling overboard through such openings.

CRANES AND DERRICKS

The crane weight must be posted on all mobile cranes hoisted aboard vessels for temporary use.

All types of cranes must be equipped with a durable rating chart visible to the operator. This chart covers the complete range of the manufacturer's capacity ratings, for which the cranes are certified where required. The rating chart includes all operating radii for all permissible boom lengths and jib lengths, with and without outriggers that may be fitted. It also includes alternative ratings with optional equipment affecting such ratings, and all necessary precautions or warnings.

Operating controls must be marked or an explanation posted at the operator's position to indicate the function. A boom angle or radius indicator must be fitted where necessary.

All shore-based derricks must be clearly marked to indicate all applicable capacity ratings. This is based on manufacturer's (or design) data for which certified. Such ratings and any necessary precautions or warnings must be visible to the operator. Operating controls must be marked or an explanation posted at the operator's position to indicate their function.

The rated safe working loads of each crane and derrick are not to be exceeded. Counterweights in excess of manufacturer's (or design) specifications must not be fitted. All equipment must be used in accordance with manufacturer's specifications and recommendations.

Pulling barges or rail cars and bulling cargo in such a way as to exert side loading stresses upon crane booms are not permitted.

No crane or derrick should be used where a visible defect affecting safe use exists.

Every crane used to load or discharge cargo into or out of a vessel must be fitted with a load indicating device or alternative device in proper working condition which will provide, as a minimum:

- A direct indication, in the cab, of the weight being hoisted
- An indication, in the cab, of the radius and load at the moment.

Devices may also be used which will prevent an overloaded condition from occurring.

The accuracy of a load indicating device, a weight-movement device, or an overload protection device must be within a range of not less than 95 percent nor more than 110 percent of the actual true total load (5 percent overload, 10 percent underload). These devices permit the operator to determine before making any lift that the indicating or substitute system is operating. Checks on accuracy using known values of load must be performed at the time of every certification survey, and at additional times as may be recommended by the manufacturer.

When the load indicating device or alternative system is placed in the supporting system (crane structure) so that its failure could cause the load to be dropped, its strength is not to be the limiting factor of the supporting system. Markings are to be placed giving:

- Units of measure in pounds or both pounds and kilograms

- Capacity of the indicating system
- Accuracy of the indicating system
- Operating instructions and precautions.

In the case of systems using indications other than actual weights, the following data must be provided:

- Capacity of the system
- Accuracy of the system
- Operating instructions and precautions
- The means of measurements.

If the system used does not automatically stop when the crane reaches its load limits, markings must be provided giving the make and model of the device installed, a description of what it does, how it is operated, and any necessary precautions regarding the system. All weight indications, other types of loading indications, and

other data required should be readily visible to the operator.

All load indicating devices must be working over the full operating radius. Overall accuracy is based on actual applied load and not on full scale (full capacity) load.

Working areas within the swing radius of the outermost part of the body of a revolving crane must be temporarily guarded by ropes or other suitable means during cargo operations. This is to prevent personnel from being caught between the body of the crane and fixed parts of the vessel or of the crane itself.

During the hours of darkness, make sure that enough light is provided in the work area to carry out operations safely.

The posted safe working loads of mobile crawler or truck-mounted cranes under the conditions of use must not be exceeded.

HANDLING CARGO

SLINGING

Make sure that drafts are securely slung prior to hoisting. Remove any loose dunnage or debris sticking out from the draft.

Cargo handling bridles (such as pallet bridles) which are to remain attached to the hoisting gear while hoisting drafts must be attached by shackles or other positive means. This is to prevent them from accidentally coming loose from the cargo hook.

When hoisting long drafts such as lumber, pipe, dunnage, and other pieces, use double slings to prevent the top pieces from sliding off.

Double slings must be used on unstrapped dunnage, except when it is impractical to use them because of the size of the hatch or deep tank openings.

BUILDING DRAFTS

Build drafts so that cargo will not fall from them.

Case hooks must not be used for handling cases into or out of the vessel, unless the cases are specifically made to be handled by this means.

Bales of cotton, wool, cork, wood pulp, gunny bags, or other similar articles should not be hoisted into or out of the vessel by their straps. (An exception to this is if the straps are strong enough to support the weight of the bale and two hooks.)

Loads requiring continuous manual guidance while in motion must be provided with tag lines.

Drafts should not be hoisted unless the winch or crane operator(s) can clearly see the draft itself or see the signals of any signalman associated with the operation.

Do not load buckets or tubs used in handling bulk cargo above their rims.

STOWED CARGO, TIERING, AND BREAKING DOWN

In breaking down, take precautions to prevent the remaining cargo from falling. Before securing any reefer compartment, check to make sure

that no personnel remain inside. Make frequent checks to insure the safety of any personnel working alone in a tank or cargo compartment.

BULLING CARGO

Bulling cargo is normally done with the bull line led directly from the heel block. Bulling may be done from the head of the boom when the nature of the cargo and the surface over which it is dragged are such as to avoid stalling the load. It may also be done when the winch actually does not have enough strength with the purchase used to overload the boom.

Falls from cargo booms of vessels should not be used to move scows, lighters, or railroad cars.

Snatch blocks should be used to provide a fair lead for the bull line. This is to avoid unnecessary

dragging of the bull line against coamings and obstructions.

Snatch blocks should not be used with the point of the hook resting on the flange of a beam, but must be hung from padeyes, straps, or beam clamps. Snatch blocks or straps are also not to be fastened to batten cleats or other insecure fittings.

Beam or frame clamps should be secured to the beam in such a manner as to minimize the possibility of their slipping, falling, or being pulled from the beam.

CONTAINERIZED CARGO

For the purpose of this section, the term "container" means a reusable cargo container of rigid construction and rectangular configuration. It is intended to contain one or more articles of cargo or bulk commodities for shipment aboard a vessel. It is capable of using one or more other modes of transport without intermediate reloading. The term includes completely enclosed units, open top units, half or other fractional height units, units incorporating liquid or gas tanks, and any other variations serving the same basic purpose. All must fit into the container system, demountable or with attached wheels. The term, however, does not include cylinders, drums, crates, cases, cartons, packages, sacks, unitized loads, or any other of the usual forms of packaging.

Every cargo container must be permanently marked in pounds as to:

- The weight of the container when empty
- The maximum cargo weight that the container is intended and designed by its manufacturer to carry
- The sum of these two weights.

No container is to be loaded aboard or discharged from any vessel by means of hoisting ship's cargo handling gear or shore crane or derrick unless the following conditions have been met.

An empty container must be identified as an empty container. This can be done either by marking or in cargo stowage plans, or by both means.

The actual gross weight of a loaded container must be plainly marked so as to be seen by the operator of the crane or other hoisting equipment, or the signalman. The actual gross weight, the exact stowage position, and the serial number or other positive identification of that specific container must be available to all personnel involved in the operation.

Every outbound loaded container received at a marine terminal ready to load aboard a vessel without further consolidation or loading must be weighed to obtain the actual gross weight, either at the terminal or elsewhere, before loading aboard a vessel.

NOTE: The following statements do not pertain to open-type vehicle-carrying containers and those built and used solely for carrying compressed gases.

When container-weighing scales are located at a marine terminal, any outbound container with a load consolidated at that terminal must be weighed to obtain an actual gross weight before loading aboard a vessel.

When there are no container-weighing scales available, the actual gross weight may be calculated. This is provided that accurate weights of all contents are known and a list of the same including the empty container weight is totaled and posted on the container. Such list of contents may refer to cartons, cases, or other means of packaging. It need not specifically identify the commodity or commodities involved except as otherwise required by law. Inbound containers are subject to random sample weight checks at the nearest weighing facility. If errors are found in the weight of the containers, they may not be allowed to be loaded on the vessel.

If loaded inbound containers from foreign ports have not been weighed, they must have the calculated weight posted in the manner described above. All loaded inbound containers from foreign ports must be subject to random sample weight checks at a time satisfactory to

the Administration. This weight check may be at any time up to unloading the contents of the container at the terminal or until the container is delivered unopened to the land carrier. When such checks indicate incorrect weight of the containers, some suitable means to protect the safety of the personnel involved must be taken during discharge to assure safety until the correct weights are furnished.

Any scale used within the United States to weigh containers must meet the accuracy standards of the state or local public authority in which the scale is located.

No container is to be hoisted if its actual gross weight exceeds the weight marked, and it may not be hoisted if it exceeds the capacity of the crane or other hoisting device intended for use. All hoisting of containers must be by means which will safely do so without probable damage to the container, and using the lifting fittings provided.

All outbound containers must be inspected before loading for any visible defects in structural members and fittings. This is to make sure that they are safe prior to handling in loading. To the extent it is practicable, inspect inbound containers before discharge. Do not load any outbound container found to have a defect unless the defect is first corrected. Any inbound container found to have such a defect should either be discharged by such special means as to insure safety, or it should be emptied before discharge.

HAZARDOUS CARGO

Prior to the start of cargo handling operations, a determination must be made from labels on the cargo, from the dangerous cargo manifest, or from other shipping documents, as to what hazardous cargoes, if any, are to be handled. Personnel must be informed of the general nature of the hazard, the importance of preventing damage to the cargo, and the special precautions to be taken.

Drafts of hazardous cargo must be carefully slung and secured so as to prevent individual packages from falling as the draft is tipped. Any leaks or spills must be reported. When a spill

occurs, remove all personnel from the holds or compartments until the owner/shipper has determined the specific hazards, has provided such personal protective equipment and clothing and such ventilation and fire protective equipment as may be necessary to avoid, or protect against the hazard, and has instructed personnel as to the safe method of cleaning up and disposing of a spill or handling and disposing of the leaking containers. Clean-up or disposal is to be carried out under the personal supervision of a representative of the employer aboard the vessel.

GENERAL WORKING CONDITIONS

HOUSEKEEPING

Keep weather deck walking and working areas reasonably clear of lines, bridles, dunnage, and all other loose tripping or stumbling hazards. Remove gear or equipment not in use from immediate work areas. Place equipment so as not to present a hazard.

Eliminate slippery conditions as they occur. Keep the work area clean and clear of loose paper, dunnage, and debris.

Do not use dunnage racked against sweat battens when the levels of such racks are above the safe reach of personnel.

Stow dunnage, hatch beams, tarpaulins, or gear not in use no closer than 3 feet to the port and starboard side of the weather deck hatch coaming. When circumstances make this impossible, try to stay as close to the 3 feet limitation as possible.

VENTILATION

When internal combustion engines are used inside a hold, an intermediate deck, or any other compartment, periodic air tests should be made to determine the amount of carbon monoxide in the air. The frequency of performing these tests depends upon the type of location of the operation and the existing conditions. Such tests should be made in areas in which personnel are working. They should be made by persons competent in the use of the test equipment and procedures. Where operations are located in a deep tank or refrigerated compartment, the first test should be made within one-half hour of the time the engine(s) starts.

The carbon monoxide content of the air should be maintained at less than 50 parts per million (.005%). Remove personnel from any compartment in which the carbon monoxide concentration exceeds 50 parts per million. Allow personnel to return only after the carbon monoxide content has been brought below 50 parts per million.

When neither natural ventilation nor the vessel's ventilating system is adequate to keep the carbon monoxide concentration within the allowable limits, take other means to make sure that there is good ventilation.

Guard the intakes of portable blowers and any exposed belt drives by the use of screens. Ground the frames of portable blowers at the source of the current. Do this either through a third wire in the cable containing the circuit conductors or

through a separate wire. When the vessel is the source of the current, the ground should be made to the structure of the vessel. Electric cords used must be free of visible defects. Do not permit the use of shore electrical circuits unless they have been checked.

Keep a record of the date, time, location, and results of all carbon monoxide level tests performed for at least 30 days after the work is completed.

The air in the stowage areas must be checked to determine if it is safe for personnel to work in places where hazardous cargoes are stowed, where dry ice has been used as a refrigerant, where fumigation has taken place, or where there is a possibility of oxygen deficiencies.

Dangerous gaseous contaminants not immediately dangerous to life are gases present in concentrations that could be breathed for a short period of time without endangering the life of a person breathing them. However, these gases may produce discomfort and injury after a prolonged single exposure or repeated short exposures.

If it is determined that the work area is unsafe, do not permit personnel to enter or remain in the area until the air is safe to breathe or until suitable respiratory equipment is provided. If the air contains less than 16.5 percent oxygen, it would endanger the life of a person breathing it for even a short period of time.

OTHER HAZARDOUS CONDITIONS

When personnel are exposed to heavy concentrations of dusts, provide suitable respiratory protective equipment.

Cargo handling operations should not be carried out in the following circumstances:

- When chipping or scaling operations create noise which interferes with communication.

- When men working in the rigging overhead create a hazard of falling objects.
- Where personnel are exposed to injurious light rays, hot metal, or sparks, any of which result from welding or cutting.
- Where personnel are exposed to unsafe concentrations of dust or vapors from sand blasting or spray painting.

SANITATION AND DRINKING WATER

Cargo handling operations are not to be carried on in the immediate vicinity of uncovered garbage, nor in the way of overboard discharges

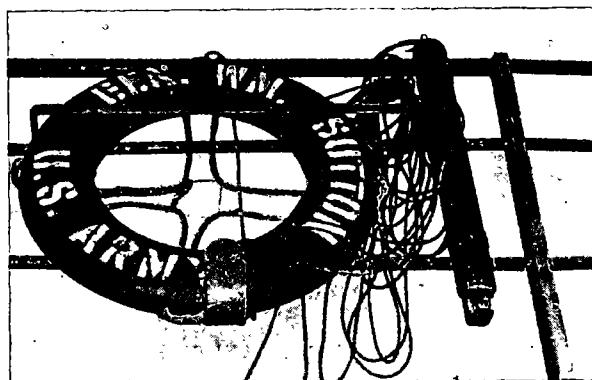
from sanitary lines unprotected by a baffle or splash boards. Drinking water should be kept in clean, covered containers.

FIRST AID AND LIFE SAVING EQUIPMENT

Unless a first aid room is close at hand and a qualified attendant is prepared to render first aid to personnel, a first aid kit must be available aboard the vessel. The contents of the first aid kit should be checked before being sent out on each job to make sure that all expended items have been replaced.

Each vessel being worked should have one Stokes basket stretcher, or its equivalent, permanently equipped with bridles for attaching to the hoisting gear. This is not necessary if there are more than two stretchers on each pier. Stretchers should be kept close to the vessels.

There should be in the vicinity of each vessel being worked at least one US Coast Guard-approved 30-inch life ring with not less than 90 feet of line attached, and at least one portable or permanent ladder which will reach from the top of the apron to the surface of the water. If this equipment is not available at the pier, it must be furnished during the time personnel are working the vessel. When working a barge, scow, raft,



lighter, log boom, or carfloat alongside a ship, a US Coast Guard-approved 30-inch life ring with not less than 90 feet of line must be provided either on the floating unit itself or aboard the ship in the immediate vicinity of each floating unit being worked.

When personnel are working on log booms or cribs, lifelines should be furnished and hung overside to the water's edge.

PERSONAL PROTECTIVE EQUIPMENT

EYE PROTECTION

When an eye hazard from flying particles or heavy dust exists, exposed personnel should

wear appropriate, authorized eye protection equipment.

PROTECTIVE CLOTHING

Personnel who are handling cargo which, due to ruptured, leaking, or inadequate containers, could cause burns, or skin irritation, or is otherwise injurious to health, must wear suitable protective clothing.

Protective clothing which has been previously worn should be cleaned and disinfected before it is reissued.

FOOT PROTECTION

Safety shoes should be worn by all personnel.

HEAD PROTECTION

Personnel must wear appropriate, authorized protective headgear when working in and around cargo operations. Protective headgear which has been previously worn should be cleaned and disinfected before it is reissued.

EAR PROTECTION

Proper ear protection devices should be worn while working in high noise areas.

SUMMARY

We have not attempted to present here a complete set of safety rules, but rather some guidelines. Any specific safety measures you should follow will vary from job to job, since specific conditions will vary from job to job. Safety, after all, is nothing more than a common sense response to a specific, potentially hazardous situation.

Before beginning any operation, first analyze it in terms of what's involved, what kind of equipment is available to do the job, the condition of the equipment, the experience of the crew, the kind of cargo being handled, the condition and

layout of the ship, and so on. If you will run through the operation in your mind before actually beginning the work, you will usually be able to see where potential hazards might exist. Eliminate all that you can before the operation begins. If some develop during the operation, stop work and eliminate those also. Common sense, professionalism, and the use of effective protective devices will prevent any remaining *potential* hazards from becoming *real* ones — and you or members of your crew from becoming accident statistics.

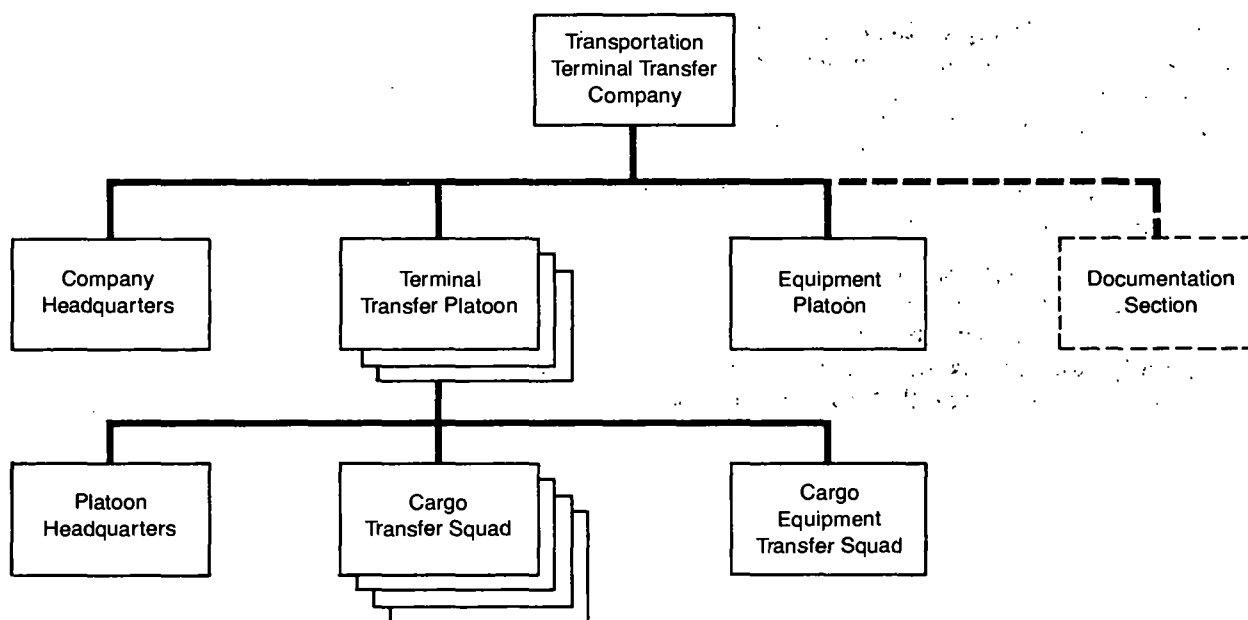
CHAPTER 11 TRANSFERRING BREAKBULK AND CONTAINERIZED CARGO

In addition to loading or discharging vessels in a fixed port, the terminal operations coordinator may also be assigned to a terminal transfer company. In a terminal transfer company, you will be required to change or transfer the cargo from one type of transportation to another. This chapter will give you a better understanding of what a terminal transfer company is and what your duties might be in this type of unit.

ORGANIZATION

The transportation terminal transfer company consists of three terminal transfer platoons, an equipment platoon, and a company headquarters.

When required, a documentation section may be attached.



TERMINAL TRANSFER COMPANY (TOE 55-118).

MISSION

The terminal transfer company is assigned the mission of operating either a breakbulk or container operation at an Army air, rail, motor or inland barge terminal. In a breakbulk transfer operation, this unit at full strength is involved in the unloading, segregating, temporary

holding, documenting and loading of up to 900 short tons of breakbulk cargo in a 20-hour period. In a container operation, this unit can receive, hold in transit, consolidate, and transship up to 600 containers in the same period.

ASSIGNMENTS

The company is organized so that each of its three platoons can work independently and may be deployed at the same time at different terminals.

AIR TERMINAL

Terminal transfer personnel may be assigned to the air terminal to:

- Load and unload aircraft
- Operate cargo segregation and temporary holding facilities
- Document cargo moving through the terminal.

Most of the cargo delivered by air will be unitized on 40- by 48-inch pallets. The transfer unit's forklifts will be used to unload and move cargo from the aircraft unloading point to clearance transportation. Cargo unloaded from surface carriers may have to be segregated and prepared into units compatible with aircraft space and weight capacities. The terminal transfer company is also provided with a variety of slings for rigging external loads for helicopter delivery. TM 55-450-10/1, TM 55-450-10/2, and TM 55-450-18 & 19 give specific instructions on how to load aircraft.

MOTOR TRANSPORT TERMINAL

Motor transport terminals in the corps area are normally located at both ends of a line haul operation. They form the connecting link between local haul and line haul routes, where terrain necessitates a change in the type of carrier.

Terminal transfer companies' personnel provide cargo handling services at these terminals to offload one mode of transport and load another. For details on how to load and offload vehicles in motor transport operation, refer to FM 55-30 and FM 55-70.

RAIL TERMINAL

As with the motor transport terminal, terminal transfer personnel are assigned duties of transferring cargo at a railhead. A railhead is that portion of the rail terminal where troops, supplies, and equipment are transferred. For information on loading and unloading rail cars, refer to TM 55-601 and FM 55-70.

INLAND WATERWAY TERMINAL

Terminal transfer personnel are employed only at small intermediate cargo transfer points on the inland waterway systems. The mission of terminal transfer personnel working at these terminals is to transfer cargo arriving by barges or landing craft to other modes of transport. For characteristics and capabilities of Army landing craft, refer to Appendix G.

Cargo arriving by barge or landing craft is transferred to other modes of transportation for onward movement to the consignee. The mission of changing the cargo from one mode of transport to another is the responsibility of terminal transfer personnel. The procedures used to offload and load these modes of transportation are found in FM 55-70, TM 55-601, and FM 55-20.

SUMMARY

As you can see by reading this chapter, the terminal operations coordinator is not always assigned duties of loading and discharging vessels at a fixed port. However, regardless of where he may be assigned, the basic procedure of cargo

handling remains the same. The method of storing and securing may differ with the mode of transportation being used. Specific guidelines for loading and securing cargo for each mode have been published by experts in that field.

APPENDIX A REFERENCES

A-1. Army Regulations (AR)

55-30	Space Requirements and Performance Reports for Transportation Movements
55-55	Transportation of Radioactive and Fissile Materials
55-167	Policy Governing Transportation of Cargo by Military Sea Transportation Service
55-228	Transportation by Water of Explosives and Hazardous Cargo
55-355	Military Traffic Management Regulation
56-15	Ship and Terminal Demurrage and Unused Shipping Space
59-106	Operation of Air Force Terminals
700-15	Packaging of Materiel
700-58	Packaging Improvement Report
725-50	Requisitioning, Receipt, and Issue System
742-9	Ammunition Advisors and Specialists
746-1	Packaging of Army Materiel for Shipment and Storage

A-2. Field Manuals (FM)

9-6	Ammunition Service in the Theater of Operations
10-15	Loading Container Inserts and Cargo Transporters
19-30	Physical Security
20-12	Amphibious Embarkation
21-6	How to Prepare and Conduct Military Training
21-30	Military Symbols
55-30	Army Motor Transport Operations
55-50	Army Water Transport Operations
55-60	Army Terminal Operations
55-70	Army Transportation Container Operations
101-5	Staff Officer's Field Manual: Staff Organization and Procedure

A-3. Training Circulars (TC)

21-5-7	Training Management in Battalions
55-5	Container Operations

A-4. Technical Manuals (TM)

5-725	Rigging
9-1300-206	Ammunition and Explosives Standards
38-230-1	Packaging of Materiel, Preservation (Volume I)
38-230-2	Preservation, Packaging, and Packing of Military Supplies, and Equipment (Volume II)
55-310	Motor Transport Operations
55-511	Operation of Floating Cranes
55-601	Railcar Loading Procedures
55-602	Movement of Special Freight
55-606	Military Ocean Terminals, CONUS
55-607	Loading and Storage of Military Ammunition and Explosives aboard Merchant Ships

A-5. Department of the Army Pamphlets (DA Pam)

310-2 Index of Blank Forms

A-6. Tables of Organization and Equipment (TOE)

55-116 Headquarters and Headquarters Company, Transportation Terminal Battalion

55-117 Transportation Terminal Service Company

55-118 Transportation Terminal Transfer Company

A-7 Department of Defense (DOD) Publications

DOD Reg Military Standard Transportation and Movement Procedures

4500.32-R

MIL-STD-129 Marking for Shipment and Storage

MIL-STD-147 Palletized and Containerized Unit Loads 40" by 48" Pallets, Skids, Runner on Pallet-Type Base

A-8. US Coast Guard (CG) Publications*

108 Rules and Regulations for Military Explosives and Hazardous Munitions

174 Manual for the Safe Handling of Inflammable and Combustible Liquids

176 Loadline Regulations

203 Merchant Marine Safety Manual

257 Rules and Regulations for Cargo and Miscellaneous Vessels

A-9. Military Sealift Command (MSC) Publication**

MSC P504 Ship Register

To order publications, write:

*US Coast Guard

1360 E. Street, NW

Washington, DC 20226

**Naval Publications Center

5801 Tabor Avenue

Philadelphia, PA 19120

APPENDIX B FORMULAS

SHACKLES AND CHAINS

$$\text{SWL} = 6 \times D^2$$

$$\text{BS} = \text{SWL} \times \text{SF}$$

EXAMPLE: Find the SWL and BS of an anchor or chain shackle, 1 inch in diameter

$$\text{Manufacturers SWL} = 6.5 \text{ S/T}$$

$$\text{SWL} = 1 \times 1 \times 6 = 6 \text{ S/T}$$

$$\text{BS} = 6 \times 5 = 30 \text{ S/T}$$

HOOKS

$$\text{SWL} = \frac{1}{2} \times D^2$$

$$\text{BS} = \text{SWL} \times \text{SF}$$

EXAMPLE: Find the SWL and BS of a standard eye hook, 1 inch in diameter

$$\text{Manufacturers rated SWL} = 0.56$$

(using a SF of 6)

$$\text{SWL} = 1 \times 1 \times \frac{1}{2} = 0.66 \text{ S/T}$$

$$\text{Manufacturers BS} = 0.56 \times 6 = 3.36$$

$$\text{Using a SF of 5, BS} = 0.66 \times 5 = 3.30$$

WHERE: BS = Breaking Strength

SF = Safety Factor

S/T = Short Ton

SWL = Safe Working Load



1

2

3

4



5

6

7

8

9

10

11



APPENDIX C ABBREVIATIONS

For additional abbreviations see MILSTAMP Appendix B 90.

PACKAGE UNIT

Description	Abbreviation	Description	Abbreviation
Bag	BG	Carton	CT
Bale	BE	Case	CS
Barrel	BL	Crate	CR
Box	BX	Drum	DR
Bundle	BD	Package	PG
Can	CN	Pallet	PP

QUANTITATIVE UNITS

Description	Abbreviation	Description	Abbreviation
Dozen	DZ	Loose	LS
Each	EA	Lot	LO
Hundred	HD	Thousand feet	MF

WEIGHTS AND MEASURES

Description	Abbreviation	Description	Abbreviation
Board foot	BF	Measurement ton	MT
Cube	CU	Pound	LB
Cubic foot	CF	Short ton	S/T
Gallon	GL	Square foot	SF
Linear foot	LF	Volume	VO
Long ton	L/T	Weight	WT



10

11

12

13



14

15

16

17

18

19

20



APPENDIX D KNOTS, BENDS, AND HITCHES

Many different kinds of knots, bends, and hitches are discussed here. Here are some things you should know about the different parts of the line. The bitter end is the very end of the rope. The bight is a loop formed by turning the rope back on itself. The standing part is the long unused portion of the rope.

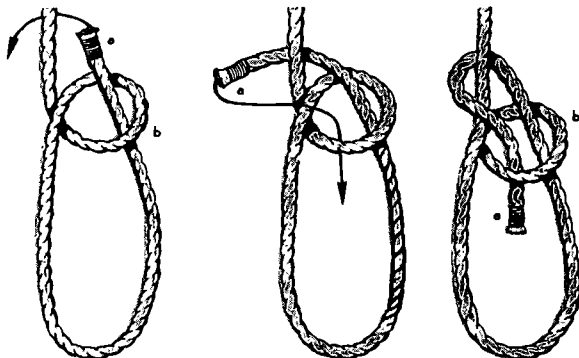
KNOTS IN A SINGLE LINE

These knots are used to fasten a line upon itself or around another object. Study the illustration of each knot.

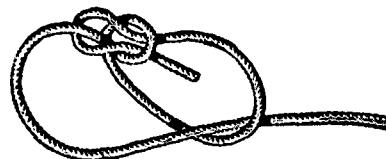
Overhand knot. This simple knot is formed by passing the end of a rope over the standing part and through the bight. It is seldom used.



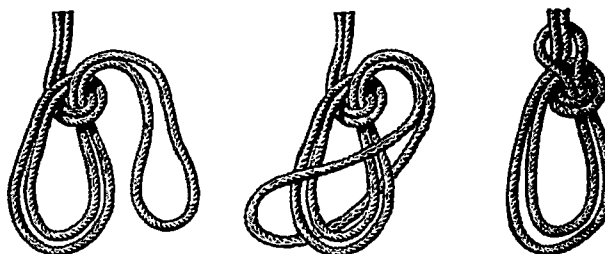
Bowline. The bowline, one of the most common and useful knots forms an eye which may be of any length and cannot slip. It is used for lowering men over the side, for forming an eye in the end of a hawser to throw over a bollard when handling a ship alongside a wharf, and for a great variety of similar purposes. A bowline is made by forming a bight in the line with the end part on top, bringing the end part up through the bight, then passing it under the standing part above the bight, and back through the bight.



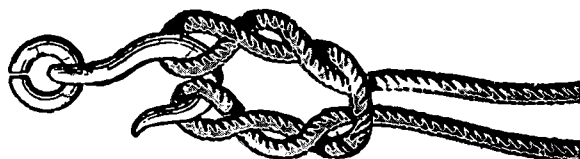
Running bowline. This is formed by making a bowline and pulling the standing part through the eye.



Bowline on a bight. This knot is made with the bight of a line. A loop is formed with the bight, then the end of the bight is pulled up through the loop and back over the newly formed loop, up over, and pulled tight.



Cat's paw. A convenient, secure, double loop is formed by twisting two bights of a rope and passing the hook of a tackle through them.



Sheepshank. The bight of the rope is laid in three parts, and each part half-hitched around the bight of the other two parts. The sheepshank is used to shorten a line or bypass a weak spot.

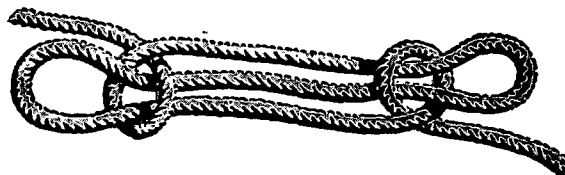
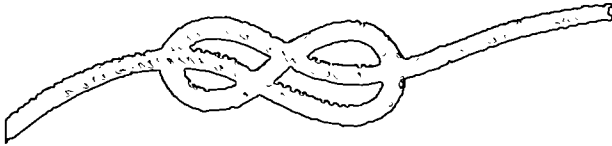


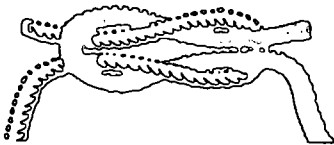
Figure of eight. This knot resembles the figure eight and is used to prevent the end of the rope from unreeving when rove through blocks. The end of the rope is passed around the bight over its own part and through the loop.



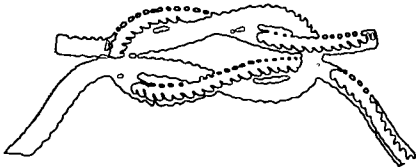
KNOTS USED FOR BENDING TWO LINES TOGETHER

These knots, are used to fasten one rope to another or to some other object.

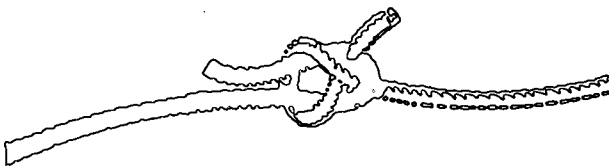
Square or reef knot. This knot is formed by making an overhand knot then crossing the ends and bringing one end up through the bight.



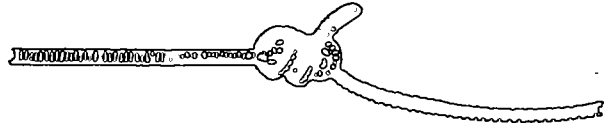
Granny knot. This knot is made something like a square knot. The granny knot should be carefully distinguished from the square knot. It should not be used because it will slip and fail to hold.



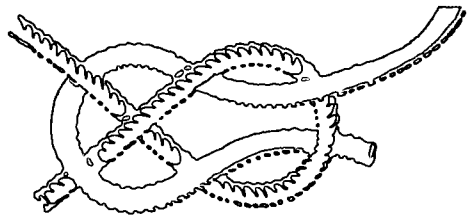
Single sheet or becket bend. This is probably the best knot to use to join two ropes of different sizes. It is made by forming a bight in one of the ropes, bringing up the other rope end through the bight, twisting it over and under the bight, and then bringing it under itself.



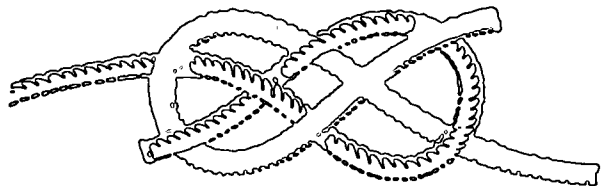
Double or becket bend. Here, the end of the bending line is passed twice around the standing line and through its own part, giving added security.



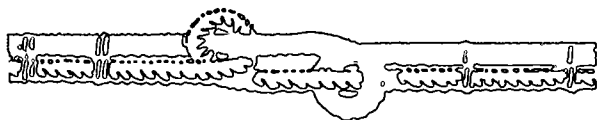
Single carrick bend. This knot is made by first crossing the end of one rope and then passing the end of the other down through the bight, under the standing part, over the end, and down through the bight again. The ends are seized to their own parts. The bend is used for joining two lines.



Double carrick bend. This bend, with both ends coming out on different sides, is more secure than the single carrick. The ends are seized to their own parts.



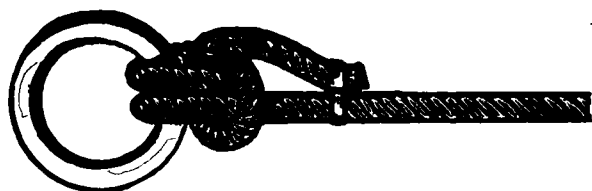
Reeving-line bend. The knot is made by taking a half hitch with each end around the other line and seizing the ends. This method connects two lines in such a way that they reeve through an opening with as little resistance as possible.



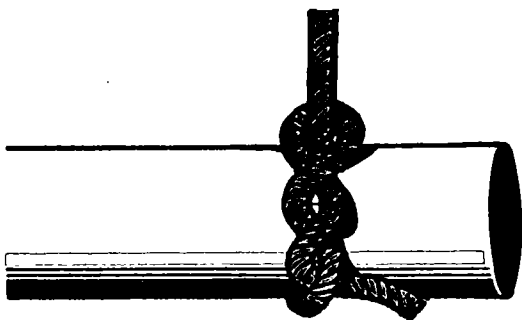
KNOTS USED IN SECURING A LINE TO A RING OR SPAR

These knots illustrated here are generally called hitches.

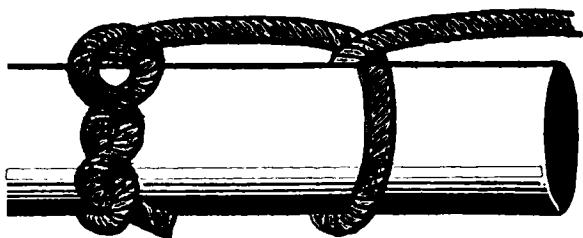
Fisherman's bend. This is formed by passing the end twice around the ring and under the turns and seizing the end back. This bend is used for securing a rope to a buoy or a line to the ring or shackle (jew's harp) or an anchor.



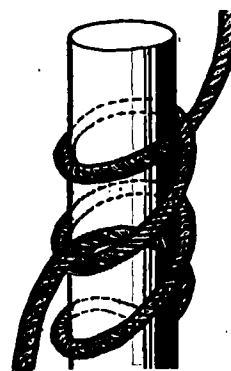
Timber hitch. This hitch is useful when lifting spars, timbers, and dunnage. It is formed by passing the end around the spar and its own standing part, then tucking several turns around the loop which is around the spar.



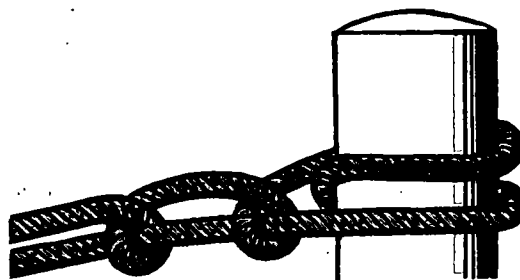
Timber hitch and half hitch. In this knot, the half hitch is taken first and the timber hitch formed afterward with the end.



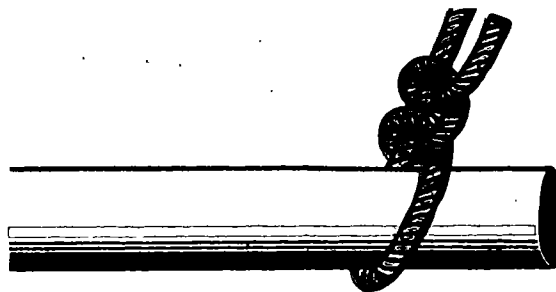
Rolling hitch. This knot is used when lifting pipe or round slender objects. The end is passed around the spar or rope-crossing and standing part on the top side each time and then the end is hitched around the spar or rope on the opposite side of the two turns.



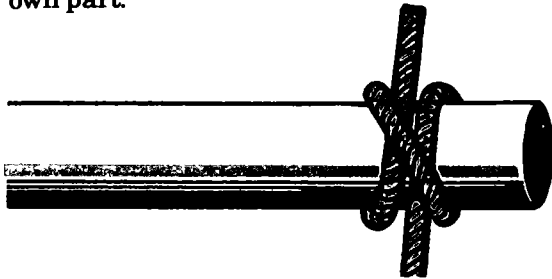
Round turn and two half hitches. This is formed by encircling a bollard, spar, or other rope twice, passing through the space between both crossovers to make second hitch.



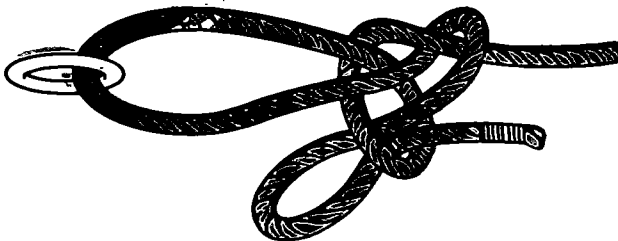
Two half hitches. This is formed by leading the end over and under and up through the standing part and repeating the process. This is another method of bending a rope's end to a spar stanchion, bollard or ring.



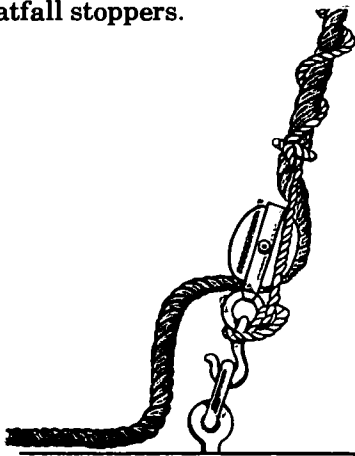
Clove hitch. This is one of the most common hitches for attaching a rope to a spar and for fastening ratlines to shrouds or to the standing part of a rope. To form this hitch, the end is passed around the spar, crossing the standing part then around the spar again, bringing the end through between the end part and standing part under its own part.



Spier knot. Tied quickly and released by a pull on the running end, this knot is used when a fixed loop, a nonslip knot, or a quick release is required. It is formed by making a loop in the standing part and drawing a second loop, formed in the working part, through the first loop.



Stopper on a line. This is short length of rope secured on one end. It is used to secure or check a running rope. Examples are mooring line stoppers or boatfall stoppers.



APPENDIX E GLOSSARY

Back haul

Shipment of material to or through an area from which the material had previously been shipped.

Back loading

The act of loading outbound cargo on a semitrailer that delivered inbound cargo.

Bail/Bale

Triangular plate of steel used to connect the bull chain, bull rope, and single topping lift. A bail is also a package of soft or nonrigid material compressed to a rectangular shape and usually covered with burlap or heavy wrapping and secured by wire or metal strapping.

Bale cubic capacity

Space available in a ship for cargo, measured in cubic feet to the inside of the cargo battens, on the frames, and to the underside of the beams.

Barge

Floating craft of full body and heavy construction, designed to carry cargo.

Batten cleats (hatch cleats)

Right-angle brackets welded to the hatch coaming to secure battens.

Battens, cross

Strips of iron or wood placed across the square of a closed hatch to hold tarps and hatch covers.

Battens, sweat (cargo)

Long planks in the hold or 'tween decks, secured to the side of the ship to protect cargo from sweat and rust.

Battens, hatch

Thin steel bars fitted tight against the hatch coaming to hold the hatch cover or tarpaulin in place.

Beam

Maximum width of a vessel.

Beam clamp

A device that attaches to the beam of the vessel for connection of other pulling devices.

Beam, hatch

Steel or wooden beam which supports hatch covers.

Beam sockets

Fittings in the coaming for hatch beams, into which flanges on the beams' ends fit.

Belay

To wind or make turns with a running line around a belaying pin or cleat to hold secure, make fast, or stop.

Bearer

Lumber laid on the deck, under the ends of vertical uprights (studs), to receive and distribute the vertical load to the deck.

Bight

Primarily the bend or loop in a rope.

Bilge

Rounded portion of a vessel's shell which connects the bottom with the sides. The space in the lower part of a ship's hold where waste water collects. Also the part of a barrel at its greatest diameter.

Bitts

Heavy device with bedplate and two iron posts on which mooring lines on vessels are fastened to secure the ship. A single post on a wharf is usually called a bollard.

Block

Metal or wood frame or shell containing one or more pulleys or sheaves, generally set side by side and turning freely on the same pin. The shell is fitted with a hook, eye, or strap by which the block can be secured to another object.

Block, head (cargo)

Block shackled to the head of the boom through which the cargo runner is reeved.

Block, heel

Block located near the heel of the boom through which the cargo runner is reeved.

Block, traveling

Single sheave block supported in a bight and fitted at the bottom with a load hook.

Block, snatch

A single sheave block, of which one side of the frame includes a gate that can be opened to allow the bight of a line to be placed on a sheave without reeving the end through the block.

Block, topping lift

Block through which the topping lift is reeved.

Boarding

The cargo-bearing surface of bulkhead, or securing the lines of a vessel.

Bollard

Short metal post on a wharf or pier, used for securing the lines of a vessel.

Boom, cargo

Spar extending from a mast or kingpost, like a derrick arm, to raise or lower cargo.

Boom, hatch

Boom spotted over a ship's hatch. Also called **Inboard** or **Stay boom**.

Boom, jumbo

Heavy-lift boom with a safe working capacity from 10 to more than 150 tons.

Boom, outboard

Boom spotted over the ship's side, wharf, or lighter. Also called **Yard boom**.

Boom table

Outrigger or shelf built around a mast or kingpost to support the pivots of a number of booms.

Bottom

Underwater part of the hull, extending from the keel to the curved portion of the vessel's sides.

Bottom cargo (weight cargo)

Cargo which usually is, but need not be, stowed in the holds, and so is ordered delivered first at the wharf. It is cargo that is heavy in proportion to its size. Examples are tanks, machinery, and metal plates.

Brace

A structural member used to transmit, divert, or resist weight or pressure.

Bracing

Act of holding anything in place, usually by supporting it laterally.

Brake, dynamic or rheostatic

A system using the electric motor for braking. Motors are allowed to run as generators, supplying power to resistances.

Brake, magnetic

A method of braking in which force is applied and released by an electromagnet.

Break bulk

To unload and distribute a portion or all of a shipment.

Breakbulk point

A transshipping activity to which multiple shipment units may be consigned for further distribution within the transportation system.

Breakbulk ship

A ship with conventional holds for storage of noncontainerized general (breakbulk) cargo below or above deck, and equipped with cargo handling gear. Ship may also be capable of carrying above or below deck a limited number of containers secured by conventional methods.

Bridle

Span of line or chain, so fastened at the ends that another line or chain may be attached to its middle or bight.

Bulkhead

Partition which subdivides the interior of a vessel.

Bulkheading

Segregating or partitioning off of cargo by erecting a wooden wall between packages of one item and those of another.

Bull chain

Heavy chain on a single topping lift, used to hold the boom in a vertical working position.

Bull line

Line used to top or lower a boom rigged with a single topping lift.

Bulwark

A short, solid continuation of the vessel's side plating above the edge of an exposed deck, providing protection from the sea and preventing the loss of material or personnel.

Bull wire

Wire rope used for operating topping lift tackle.

Burton

Tackle used for various purposes, as for hoisting rigging aloft. Also the outboard boom and fall.

Bunker

Hull compartment used for the stowage of coal or fuel oil.

Cantline

Recess at the center of four barrels, caused by the curvature of barrels stowed one against the other.

Capstan

A vertical revolving drum, spool shaped, generally used for heaving in towing or mooring lines.

Cargo

Freight carried by a ship.

Cargo booking

The designation/nomination of a vessel for shipment of offered cargo by a Military Sealift Command cargo clearance order.

Cargo fall

See **Fall** or **Cargo runner**.

Cargo boom

Spar extending from a mast or kingpost to handle cargo.

Cargo hook

Heavy steel hook secured to the end of the cargo runners and used to hoist drafts of cargo.

Cargo offering

A requirement placed on a movement control authority by a shipping activity to obtain instructions for shipment of cargo.

Cargo runner

Rope or cable used to draw up or lower cargo draft.

Carload shipment

A quantity of freight equal to, or in excess of, the minimum weight specified for a carload in carrier's tariffs.

Carry away

To break or tear loose.

Cathead

Outside spool on a winch, used in handling hauling lines and in topping and lowering booms.

Catwalk

Footwalk, constructed around and over obstructions, for the convenience of the crew.

Ceiling planks

Planking fitted on top of the floor or double bottom in the cargo hold.

Cellular construction

Ship is fitted with vertical guides (similar to those in an elevator shaft) into which the container fits and which constrain it at the four corners. The containers are stacked one above the other with the bottom container taking the static and dynamic vertical load resulting from those resting on it. The entire load is transferred through the corner posts of the containers to a reinforced doubling plate on the tank top or bottom of the hold.

Centerline

Imaginary fore-and-aft line extending from the bow to the stern through the vessel's center.

Chafe

To wear the surface of a rope by rubbing against a solid object.

Chock

A deck fitting through which lines can be passed. Also to block cargo in with dunnage.

Cleat

A wood or metal fitting, usually with two horns, to which a line can be temporarily secured. For example, the topping lift cleat.

Coaming

A side wall that projects above the deck and extends around a hatch's perimeter.

Containerization

The use of containers for the transport of general commodities. In a narrower sense, it is the placing of commodities in a container in a secure manner and the removal of the commodities in an orderly manner at destination.

Container

An enclosed permanent, reusable, nondisposable, weathertight shipping conveyance fitted with at least one door and capable of being handled and transported by existing equipment and modes of land and sea transport.

Containerizable cargo

Cargo that will physically fit into a container and result in an economical shipment consistent with delivery requirements and the receipt capability of the oversea command; or where container packing is a delivery requirement for operational purposes.

Continental United States (CONUS)

United States territory, including the adjacent territorial waters, located within the North American Continent between Canada and Mexico.

Consignee

Receiving agency, unit, depot, or person to whom the cargo is addressed (the ultimate destination) as shown by the shipping document.

Consignor

Agency from which shipment is made. Consignors may be depots, installations, bases, supply points, holding areas, units, or other agencies. Also called shipping activity.

Cradle (crutch)

Rest to support a boom in a horizontal position.

Crane, floating

Crane mounted on a nonpropelled barge that can be towed to the offshore side of a ship to load or unload heavy lifts.

Crane-gantry

A revolving crane with a long boom mounted on high bridge or platform moving on tracks along the length of a wharf.

Cribbing

Built-up structure of dunnage filling an empty space and supporting and securing cargo.

Crosstree

A wood or metal arm set athwartship at the top of a mast.

Crowbar

Bar of iron or steel that is wedge-shaped at its working end and is used as a pry, lever, etc.

Deck

Floor of a vessel's structure.

Deck, lower

First full-length deck above the tank tops or double bottom ceilings on two- and three-decked ships.

Deck, weather

An uncovered deck exposed to the weather.

Deckload

Cargo stowed on the weather deck of a ship.

Deep tanks

Tanks located in a ship's lower holds. They take up only a portion of a hold and can carry water ballast or dry cargo. See **Double-bottom tanks**.

Defense Transportation System (DTS)

Military controlled terminal facilities, Military Airlift Command controlled airlift, Military Sealift Command controlled or arranged sealift, and Government owned or controlled air or land transportation.

Derrick

Mechanical device intended for lifting, with or without a boom supported at its head by a topping lift for a mast, a fixed frame, or similar structure. The mast or equivalent member may or may not be supported by guys or braces. The boom, where fitted, may or may not be controlled in the horizontal plane by guys. The term shall include shear legs.

Double-bottom tanks

Watertight spaces between the bottom plating, the tank top, and the margin plates. The tanks can carry water, ballast, fuel oil, boiler-feed water, or drinking water. See **Deep tanks**.

Draft

Single sling load of cargo.

Dragline

A guide rope with blocks or blocks and tackle, with ship's gear to pull cargo into a desired position for lifting or stowing.

Drum

A cylinder on a winch around which the cargo runner is wound. Also a container for fluid cargo.

Drum end

Large steel spool on the extension of the axle of the winch drum, sometimes called gypsyhead or gypsy. (See **Gypsyhead**.)

Dunnage

Cordwood, planks, or other material used solely to protect cargo stowed on a ship.

Dunnaging

The process by which military explosives are effectively blocked, braced, and tommed aboard merchant-type vessels; also known as **Securing**.

Faceboard

Boarding affixed to bulkheads, blocksoring structures, or other securing structures to provide a bearing surface for the cargo.

Fairlead

Fitting or device used in preserving the direction of a line, chain, or wire so that it may be delivered fairly, or on a straight lead, to the sheave, drum, etc.

Fall

By common usage, the entire length of rope used in a tackle, though strict usage would limit its application to the end to which power is applied.

Filler cargo

Small packages or other suitable cargo used to fill in what would otherwise be broken stowage.

First officer

Deck officer next to master in command of ship. He takes an active interest in the correct loading of the ship for protection of the crew, cargo, and ship.

Floating pier

is made up of two or more mexafloate barges.

Floor

Plates placed vertically in the double bottoms of a vessel, usually on every frame or intercostal and running athwartship or longitudinally.

Flooring off

Dunnaging cargo between tiers. Stowing bottom layers.

Flooring

Dunnage lumber laid over the ship's metal deck to protect the cargo; also termed decking.

Frame

Ribs of a vessel.

Freeboard

Distance, measured downward or vertically, from upper edge of freeboard deck to waterline.

Freeboard deck line

Line placed at the upper edge of the freeboard deck.

Gantline

Rope rove through a block at the mast head for temporary use in rigging and unrigging.

Gear

Comprehensive term for all implements, apparatus, machinery, etc., used in a given operation, such as steering gear, running gear, and cleaning gear.

Gooseneck

Joint which connects the heel of a boom with a mast or mast table.

Guy

Line or cable to steady or swing a boom or spar.

Guy, amidship

Single guy secured to the heads of two booms to pull them inboard.

Guy, inboard

Guy that pulls a boom inboard.

Guy, outboard

Guy that pulls a boom outboard.

Guy pendant

Single wire with eyes in both ends for attaching it to the tackle and to a fitting on the boom, deck, or side.

Gypsyhead

Outside spool on a winch, used in handling hauling lines.

Hatch

Opening in a deck which gives access to cargo hold.

Hatch boom

(See Boom, hatch).

Hatch cover

Cover on top of an opening in the deck of ship, fitted into recesses in the coaming and resting on the hatch beams.

Hatch whip

Runner or fall on the boom spotted over the hatch. Also called hatch runner or Fall.

Hauling part

Part of a rope in a tackle which is hauled upon. The part made fast is the standing part.

Head block

One shackled to the head of the boom through which the cargo runner leads.

Header

Lumber placed between the tops of vertical upright (studs) and the overhead.

Heel block

A block located at the foot of a boom and fastened to a mast or kingpost. One of the blocks through which the main cargo falls is reeved.

Hold

A space allotted entirely to the carriage of cargo bounded by permanent steel bulkheads, decks, and the shell of the ship. Deck openings are provided with a means of effectively closing the hold against the weather, and for closing off each hold. The compartment above the deep tanks is termed the lower hold.

Hound band

Band with links located below the crosstree into which the shrouds and stays are shackled.

Inboard

From the ship's sides to the centerline.

Interlock switch

Device for assuring the desired sequence of operation in an electric circuit.

Jacks

Structures placed along the ship's bulkhead to support boarding in bulkhead construction.

Jumbo boom

Heavy lift boom capable of handling up to 240 tons.

Keel

Center structural member at bottom of vessel that runs from bow to stern.

Kingposts

Vertical spars, usually steel, stepped in pairs, one on each side of the centerline of the ship, supporting cargo booms.

Kickers

Primarily, relatively short lengths of lumber nailed in horizontal position and spaced between uprights, or between uprights and permanent ship's structures, to add rigidity and strength to dunnage structures.

Lacers

Long lengths of narrow-width lumber laid across and nailed to a series of braces or kickers in a symmetrical dunnage structure to maintain the position of the braces or kickers, and thus the integrity of the structure.

Lag screw

Heavy, round-shanked woodscrew usually having a square head.

Lanyard

Rope for making anything fast.

Lashing

Fastening made by passing a rope, line, or chain around an object or objects to prevent movement.

Lighter

Small vessel used for discharging or loading ships. In the Army, lighters include amphibians, landing craft, and such harbor craft as barges.

Lightering

Act of transporting cargo from one point to another within a harbor.

Line

General term given to fiber or wire rope.

Linkband

The padeyes and lugs near the boom's head to which are shackled the topping lift, head block, and guys.

Machine floor

A full double-layer floor of 2-inch lumber installed over a tier or tiers of cargo on which MHE or heavy equipment may be driven for stowage of cargo; see also **Tier deck**.

Manila

Kind of rope made from the fiber of the abaca plant.

Marry

To join any two objects together, as to marry falls in a rigging.

Marshalling yard

The yard used to stage containers.

Mast

Solid or tubular steel pole or spar, tapered, and stepped vertically on the ship's centerline to support rigging and cargo booms.

Mast table (house)

A small deckhouse built around a mast to support it and the booms. Sometimes the winches are on the mast table and their control equipment is in it. It also may house ship's gear used in stevedoring.

Mechanical advantage

Amount by which a machine multiplies the force applied to it in order to lift or move a load. The machine can be a lever, a screw, or a tackle system. If a machine exerts a force 10 times that applied to it, it has a mechanical advantage of 10.

Mexafloote barge

Made up of a number of pontoons with two outboard units.

MIL-STD-129E

Military standard marking for shipment and storage. Refer to this regulation whenever there is a question pertaining to marking or storage.

Military Van (MILVAN)

Military owned demountable container, conforming to United States and International Standards, and operated in a centrally controlled fleet for movement of military cargo. (See also **SEAVAN**).

MILSTRIP

Military Standard Requisition and Issue Procedures; it contains the instructions necessary to accomplish the objective of one system of requisitioning, issuing, receiving, and managing supplies and equipment.

Mousing

Yarn, small rope, or light wire seized across the mouth of a hook to prevent slings from slipping off.

Multiple topping lift

(See **Topping lift, multiple**).

Onboard

On or in a vessel.

Outboard

Away from the centerline, or at either side of a vessel.

Outboard boom

Boom spotted over the pier or lighter.

Outboard guy

Cable or wire that pulls a boom outboard.

Overstow

Any individual item of cargo, or, in general, all items of cargo emplaced above the lower layer(s) of stowage, in a particular compartment or stowage area. (Not to be confused with double handling in port rotation.)

Padeye

Fitting attached to a deck or flooring, having an integral base plate and vertical eye to which lashings and guys may be secured.

Pallet

A platform or skid on which lading is placed and secured. It is used to facilitate handling of small commodities by materials-handling equipment.

Peavy

Tool for handling wooden material, especially adapted for rolling or turning poles.

Pendant

Short line or wire having an eye spliced in each end. Pendants are usually named according to use, such as guy pendant.

Pontoons

See **Hatch cover**.

Pontoon causeway

Many mexafloate barges put together from the ship to the beach.

Port of debarkation

An authorized point of entry into a foreign country or CONUS.

Port of embarkation

An authorized point of departure from a foreign country or CONUS.

Preventers (guys and stays)

Heavy wire ropes used to supplement the regular guys and stays as a safety precaution when handling heavy cargo.

Purchase

Tackle or system of blocks and tackle offering a mechanical advantage.

Quay

A wharf whose length parallels the shore and has berthing accommodations on one side only.

Rack

To move a draft athwartship.

Rail

Longitudinal member around the edges of the deck as a protection, sometimes a metal bar, sometimes the top edge of the bulwark.

Reefer

Ship in which all cargo compartments are refrigerated.

Reeve

To pass a rope through a block or hole.

Rib

Any of the curved crosspieces extending from the keel to the top of the hull in a ship, forming its frameworks.

Rig

To furnish with apparatus, gear, or tackle, as to rig a boom with guys or a double purchase.

Rigging, running

That part of the rigging that includes moving or movable ropes that are hauled upon to raise, lower, or swing booms.

Rigging, standing

Semipermanent rigging which supports the masts. It is semipermanent because once in position it is not moved except for adjustment or replacement.

Roller chocks

Chocks fitted with one or two short vertical rollers to reduce friction on a line.

Runner, cargo

Rope or cable wound on the winch drum and used to raise or lower drafts of cargo.

Saddle

An "L"-shaped seat used on edges of material, under the lashing to prevent the material from being damaged or cut by the lashing.

Sagging

Straining the top members of a ship through compression and the bottom members by arching down. The strain is caused by excessive weight in the midship section.

Samson post

Same as **Kingpost**.

Save-all

Net rigged from the ship's rail to the pier to catch any cargo falling overboard.

Scupper

Hole in the bulwark level with the deck to permit water to run off.

SEAVAN

Commercial or Government owned (or leased) shipping containers which are moved via ocean transportation **without** bogey wheels attached; i.e., lifted on and off the ship. (Also see **Military Van (MILVAN)**).

Securing

The process by which military explosives are effectively blocked, braced, and tommed aboard cargo vessels; also known as **Dunnaging**.

Securing material

The lumber (block, braces, bulkheads, decks, encasements, frames, jacks, magazines, sheathing, and stripping) and lashing gear used to secure cargo for the purpose of preventing damage during transport; also referred to as **Dunnage**.

Seizing

Light strands tied about loose ends of cable or rope to prevent raveling. Three seizings are usually required on an end. Seizing is also the binding or finished work where small rope or light wire was used. See **Mousing**.

Separation cloth

Sheet of gunny cloth used to prevent the mixture of cargo.

Shackle

U-shaped iron link with a removable pin used to make lines or blocks fast.

Shaft alley

Watertight passage housing the propeller shafting from the engine room to the bulkhead where the stern tubes begin. It gives access to the shafting and its bearings and also prevents their being damaged by cargo put in the spaces through which it passes.

Sheave

Grooved wheel inside a block.

Sheer angle

As related to dunnaging practices, the angle produced at a given location by the upward curve of a vessel's sides from keel to main deck. This is not to be confused with the technical definition. The angle produced at a given location by the fore-and-aft curvature from bow to stern of a ship's deck, as viewed from a side elevation.

Shipping Activity

A military activity or other agencies subject to this regulation that plan for, physically assemble, consolidate, document, and arrange for movement of material for the Account of the Military Departments or other authorized agencies.

Spotting

The positioning of cargo at points along the berth adjacent to the ship's hatches to permit handling by shipboard cranes.

Square of the hatch

Space directly under the hatch and the same size as it.

Stanchion

Upright pillar supporting the decks, awnings, and so forth.

Stay

Line or wire running fore and aft and used to support a mast, spar, or funnel.

Stay boom

See **Boom, hatch**.

Standing rigging

Rigging which is not hauled upon.

Step

Attach or fasten a mast or vertical spar to a ship's deck. Fasten booms to the mast table or to kingposts.

Stiffeners

The vertical metal columns employed in the ship's structure to stiffen a permanent bulkhead.

Stopper

Piece of rope or chain used to secure a line under a load.

Stowage

Compact placing of cargo aboard a ship.

Stress

The result of external pressure or force on a body; the structural resistance to such force; the intensity of a force or pressure, usually measured in pounds per square inch.

Stringers

Long lengths of wide lumber connecting and supporting upright in a frame to maintain the integrity of the structure.

Stripping

Lumber laid over the stow for protection from the over stow.

Strip sheathing

The vertical risers nailed to the sweatboards for protection of the stow and to permit attachment of the appropriate dunnage structure.

Shed, transit

Structure on a wharf protecting cargo, stores, or passengers.

Shifting boards

Temporary partitions placed in holds to prevent bulk cargo from shifting.

Ship platoon

Platoon of a transportation terminal service company that moves cargo to or away from shipside.

Shoring

Act of supporting anything by bracing it from below.

Single topping lift

One made of only one line shackled to the head of the boom, rove through a block at the mast, and led below to the bail.

Slack

To ease up on or pay out a line.

Sleeper

Heavy piece of timber laid on the deck to support something, such as the wheels of a locomotive.

Sling

Arrangement of line or chain around a draft of cargo to make it safe for hoisting.

Snatch block

Single block with a gate on one side of the frame which may be opened to allow the bight of a line to be placed on a sheave without reeving the end through the block.

Snotter

Line with an eye in each end that is put around a post, stanchion, etc., for a fairlead, or used for the same purpose as a sling.

Spacers

Lengths of lumber secured between unit loads or containers to create sufficient space to prevent their chafing together.

Spanner stay or truss

Wire stay or structural steel span which runs athwartship between the heads of a pair of kingposts.

Splice

To weave loose ends of fiber or wire rope together.

- Spool**
Drum whose surface is concave, used as a winch head.
- Spot**
To swing the booms to any desired position by means of the boom guys.
- Stripping**
The removal of cargo from a container.
- Structural lumber**
One of the three main classes of softwood.
- Stuffing**
The placement of cargo into a container, including any necessary chocking, bracing, or dunnaging.
- Superstructure**
Any structure extending above the upper or main deck as a continuation of the main framing, such as a bridge house.
- Surge**
To slack off a line. To allow a line to slip slowly around a fitting.
- Sweatboards**
Lumber running horizontally and mounted in hangers along the skin of the ship to protect cargo from contact with moisture or sweat which condenses on the interior of the hull; also termed sweatbattens.
- SWL (safe working load)**
Maximum weight or load which a part of the ship's gear will support with safety.
- Tank top**
Plating laid on the floors of a vessel which forms the top side of the tank sections or double bottoms.
- Tarpaulin, hatch**
Painted or treated canvas covering for a hatch.
- Tender ship**
Vessel of which the center of gravity is too high, causing a lack of stability.
- Terminal**
An established shoreside installation at which passengers and/or cargo are trans-shipped between ocean-going ships and inland transport equipment.
- Terminal operations coordinator**
One who works at or is responsible for unloading/loading a ship.
- Thimble**
Fitting for a closed eye splice.
- Tier deck**
A full floor capable of supporting forklift equipment installed to facilitate stowage of additional cargo; also termed "machine" floor at certain shiploading activities.
- Tie rod**
Rod serving as a tie between two pieces, acting in tension to keep them from separating.

Tipping angle

Angle at which an item of cargo, longer than the hatch opening, must be tipped if it is to be stowed in a hold.

Tomming

Act of bracing cargo from above to hold it down.

Ton, long

2,240 pounds.

Ton, measurement

Unit of volume equal to 40 cubic feet.

Ton, short

2,000 pounds.

Top

To raise a boom from its cradle to a working position.

Top mast

Mast above the lower mast.

Topping lift

Wire rope used to raise or lower a boom to support it in a working position.

Topping lift block

One through which the topping lift is rove.

Topping lift, multiple

Topping lift made of a tackle system, with one block shackled to the boom's head and the other shackled to the mast, and the hauling part leading below.

Topping lift, single

Topping lift made of only one line shackled to the boom's head, rove through a block shackled to the mast, and led below to the bale.

Topping lift span

Stationary topping lift shackled into the head of the boom and the head of a kingpost.

Topping off

Use of filler cargo to reduce broken stowage at the top of hold.

Transshipment

To change the cargo from one mode of transportation to another.

Truckload

See **Carload shipment**

Turnbuckle

Internally threaded collar turning on two screws threaded in opposite directions.

'Tween deck

Any deck below the upper deck and above the lowest deck. Abbreviation of **between deck**.

Two-block

To draw two blocks together so that no more hoisting is possible.

Unitized cargo

A load consisting of a single item or many small items of cargo consolidated into one large package.

Ventilator

Device for furnishing fresh air to compartments below deck or for exhausting foul air.

Void

Spaces between units of cargo in stowage and between units of cargo and ship's structure.

Void table

Prefabricated structure use in voids for supporting load above.

Weather deck

Deck having no overhead protection.

Whaler

Length of board fastened to a series of uprights on the side opposite the load-bearing surface for the purpose of stiffening and aligning the structure.

Whips

The portion of cargo-hoisting falls that fastens to the cargo.

Winch

Machine used for loading and discharging cargo or for hauling on lines. Some winches are made to turn by hand, most by steam, electricity, or gasoline.

Winch head

Drum, usually of small diameter and concave, on a winch, designed for taking and holding the turns of a rope. (See **Gypsyhead**).

Windlass

Special form of winch used to hoist or lower the anchor. It has two drums, called wild-cats, designed to grab the links of the anchor chains, and is fitted with a ratchet and braking device, situated for paying out the anchor chain.

Wings

Part of a hold or deck out near the sides.

Yard boom

See **Boom, outboard**.

Yard lumber

One of the three main classes of softwood lumber. It consists generally of lumber that is less than 5 inches in thickness and that is intended for general building purposes.

Terminal operations personnel must be able to solve various types of mathematical problems that arise pertaining to the proper and effective handling, stowing, shipping, etc., of military cargo. To make this task easier and to insure correct answers and results, numerous tables are available. Basic conversion tables are included in this appendix.

CUBIC AND VOLUME MEASUREMENTS

Cubic centimeters	Cubic inches	Cubic feet*	Cubic yards	US gallons		US bushels	Measurement tons
				Liquid	Dry		
1.0	0.061	0.0000353	0.0000013	0.000264	0.000227	0.000028	0.00000088
1,000.0	61.023	0.0353	0.00131	0.2642	0.227	0.0284	0.000882
16.39	1.0	0.0005787	0.0000214	0.00433	0.00372	0.00465	0.0000144
28,317.0	1,728.0	1.0	0.03704	7.481	6.4285	0.80356	0.025
764,559.0	46,656.0	27.0	1.0	201.974	173.57	21.696	0.677
946.4	57.75	0.03342	0.00124	0.25	0.2148	0.02686	0.000837
1,101.2	67.201	0.03889	0.00144	0.2909	0.24	0.0313	0.000975
3,785.4	231.0	0.13368	0.00495	1.0	0.8594	0.1074	0.00335
4,404.9	268.803	0.15556	0.00576	1.1636	1.0	0.125	0.00388
35,239.3	2,150.42	1.2445	0.0461	9.3092	8.0	1.0	0.0312
1,130,000.0	69,120.0	40.0	1.48	298.0			

*A board foot, used in measurements for lumber, measures 12" x 12" x 1". Its volume is 1/12 of a cubic foot.

US dry measure: 1 bushel = 4 pecks = 8 gallons = 32 quarts = 64 pints

US liquid measure: 1 gallon = 4 quarts = 8 pints = 32 gills = 128 fluid ounces = 0.83268 imperial gallon

WEIGHT MEASUREMENT

Kilograms (kg)	Ounces		Pounds		Tons Short (2,000 lb)	Tons long (2,240 lb)	Metric (1,000 kg)
	Troy	Avoirdupois (avdp)	Troy	Avoirdupois (avdp)			
1.0	32.1507	35.274	2.67923	2.20462	0.001102	0.0009842	0.001
0.0000648	0.002083	0.0002286	0.0001736	0.0001429	0.00000007	0.00000006	0.00000006
0.0311	1.0	1.09714	0.08333	0.06857	0.00003429	0.00003061	0.0000311
0.02385	0.91146	1.0	0.07595	0.0625	0.00003125	0.0000279	0.00002835
0.37324	12.0	13.1657	1.0	0.82286	0.0004114	0.0003674	0.0003732
0.45359	14.5833	16.0	1.21528	1.0	0.0005	0.0004464	0.004536
907.185	29,166.7	32,000.0	2,430.56	2,000.0	1.0	0.89286	0.90719
1,016.05	32,666.7	35,840.0	2,722.22	2,240.0	1.12	1.0	1.01605
1,000.0	32,150.7	35,274.0	2,679.23	2,204.62	1.10232	0.98421	1.0

LINEAR MEASUREMENT

Meters*	Inches	Feet	Yards	Miles		Kilometers	Fathoms
				Statute	Nautical		
1.0	39.37	3.28083	1.09361	0.0006214	0.0005396	0.001	0.546
0.0254	1.0	0.0833	0.0278	0.00001578	0.00001371	0.0000254	0.0139
0.3048	12.0	1.0	0.3333	0.0001894	0.0001645	0.0003048	0.167
0.9144	36.0	3.0	1.0	0.0005682	0.0004934	0.0009144	0.500
5.0292	198.0	16.5	5.5	0.003125	0.002714	0.005029	2.76
20.1168	792.0	66.0	22.0	0.0125	0.01085	0.02012	11.0
1,609.35	63,360.0	5,280.0	1,760.0	1.0	0.8684	1.6094	879.0
1,853.25	72,962.5	6,080.2	2,026.73	1.15155	1.0	1.85325	1,010.0
1,000.0	39,370.0	3,280.83	1,093.61	0.6214	0.5396	1.0	546.0
219.5	8,640.0	720.0	240.0	0.1364	0.1184	0.2195	120.0
1.829	72.0	6.0	2.0	0.00114	0.00098	0.00183	1.0

*1 meter = 10 decimeters = 100 centimeters = 1,000 millimeters

**A nautical mile is the length on the earth's surface of an arc subtended by one minute of angle at the center of the earth.

Therefore, the circumference of the earth is equivalent in nautical miles to the number of minutes in a circle ($360 \times 60 = 21,600$).

SURFACE MEASUREMENT

Square meters	Square inches	Square Feet	Square yards	Square rods	Square miles (statute)	Square kilometers
1.0	1,550.0	10.764	1.196	0.03954	0.000000386	0.000001
0.00065	1.0	0.0069	0.00077	0.00000026	0.0000000025	0.0000000065
0.0929	144.0	1.0	0.1111	0.00367	0.0000000359	0.0000000929
0.8361	1,296.0	9.0	1.0	0.0331	0.000000323	0.000000836
25.293	39,204.0	272.25	30.25	1.0	0.00000977	0.0000253
4,046.8	6,272,640.0	43,560.0	4,840.0	160.0	0.00156	0.00405
10,000.0	15,499,969.0	107,639.0	11,960.0	395.37	0.00386	0.01
2,589,999.0	Sq ft $\times$ 144	27,878,400.0	3,097,600.0	102,400.0	1.0	2.59
1,000,000.0	Sq ft $\times$ 144	10,763,867.0	1,195,985.0	39,537.0	0.3861	1.0

APPENDIX G CARGO SHIPS AND ARMY LIGHTERS

MARITIME ADMINISTRATION CLASSIFICATION SYSTEM CLASSIFICATION GROUP 1 — TYPE AND LENGTH OF SHIP

Type of ship	Length designation (load waterline in feet)*							
	1	2	3	4	5	6	7	8
C Cargo-Unltd service (under 100 pax)	Under 400	400-450	450-500	500-550	550-600	600-650	650-700	700† 750
P Pax — Unltd service (100 pax and over)	Under 500	500-600	600-700	700-800	800-900	900-1000	1000 and over	
B Barge	Under 100	100-150	150-200	200-250	250-300	300 and over		
G Great Lakes cargo	Under 300	300-350	350-400	400-450	450-500	500-550	550 and over	
H Great Lakes pax	Under 300	300-350	350-400	400-450	450-500	500-550	550 and over	
J Inland cargo	Under 50	50-100	100-150	150-200	200-250	250-300	300 and over	
K Inland pax	Under 50	50-100	100-150	150-200	200-250	250-300	300 and over	
L Great Lakes tanker (ore, grain)	Under 400	400-450	450-500	500-550	550-600	600-650	650 and over	
N Coastwise cargo	Under 200	200-250	250-300	300-350	350-400	400-450	450 and over	
Q Coastwise pax	Under 200	200-250	250-300	300-350	350-400	400-450	450 and over	
R Refrig	Under 400	400-450	450-500	500-550	550 and over			
S Special ‡	Under 200	200-300	300-400	400-500	500-600	600-700	700 and over	
T Tanker	Under 450	450-500	500-550	550-600	600-650	650-700	700 and over	
U Ferries	Under 100	100-150	150-200	200-250	250-300	300-350	350 and over	
V Towing ships	Under 50	50-100	100-150	150-200	200 and over			
D Outside designs	This letter will be assigned to plans received from outside companies. If designs are developed from these for contracts, a design letter will be assigned.							

* Up to but excluding the upper limit of each interval.

† Longer vessels will continue to carry successive numerical sequences in 50-foot increments; i.e., C9-700-800, etc.

‡ This special designation will apply to certain Navy Department ships which may be built by the Maritime Administration and those of such a special nature that they fall outside of any of the other designations given in this table.

**MARITIME ADMINISTRATION CLASSIFICATION SYSTEM
CLASSIFICATION GROUP 2 — TYPE OF MACHINERY AND
NUMBER OF PROPELLERS AND PASSENGERS**

Type of machinery	Propellers	12 Passengers and under*	Over 12 passengers†
Steam	Single	S	S1
Motor	Single	M	M1
Turboelectric	Single	SE	SEL
Diesel electric	Single	ME	MEL
Gas turbine	Single	G	G1
Gas turboelectric	Single	GE	GEL
Nuclear	Single	N	N1
Steam	Twin	ST	S2
Motor	Twin	MT	M2
Turboelectric	Twin	SET	SE2
Diesel electric	Twin	MET	ME2
Gas turbine	Twin	GT	G2
Gas turboelectric	Twin	GET	GE2
Nuclear	Twin	NT	N2
Steam	Stern wheel	SW	SO
Motor	Stern wheel	MW	MO

* Triple and quadruple screw add TR or Q respectively to single screw designation. Example: Triple screw motor ship is MTR.

† Triple and quadruple screw and make digit 3 or 4 respectively.

**AVERAGE DESIGN CHARACTERISTICS OF REPRESENTATIVE
MARITIME ADMINISTRATION DRY CARGO VESSELS**

Design	Length overall (LOA) (ft)	Draft loaded (ft)	Speed (knots)	Deadweight tonnage (Lton)	Gross tonnage	Average bale capacity (cu ft)	No. holds	Heavy lift capacity (Ston)	No. containers (8x8x20)
C1-M-AV1 C2	339	23	10.5	5,995	3,805	228,000	4	30	
C2-S-AJ1	459	28	15.5	10,775	8,258	543,000	5	50	
C2-S-AJ5	459	28	15.5	10,497	8,228	449,000	5	50	
C2-S-B1	459	27	15.5	10,500	6,132	546,000	5	30	
C2-S-E1 C3	469	27	15.5	10,700	6,065	546,000	5	30	
C3-S-33a	483	31	18	12,402	9,252	425,000	5	75	
C3-S-37c	495	30	18	11,336	9,296	565,000	5	60	
C3-S-37a	495	30	17.4	10,948	9,218	549,000	5	60	
C3-S-37d	495	30	18	11,367	9,459	546,000	5	60	
C3-S-38a	493	28	18.5	10,967	7,849	575,000	6	50	
C3-S-43a	506	31	18	13,116	9,827	632,000	7	60	

**AVERAGE DESIGN CHARACTERISTICS OF REPRESENTATIVE
MARITIME ADMINISTRATION DRY CARGO VESSELS (Continued)**

Design	Length overall (LOA) (ft)	Draft loaded (ft)	Speed (knots)	Deadweight tonnage (Lton)	Gross tonnage	Average bale capacity (cu ft)	No. holds	Heavy lift capacity (Ston)	No. containers (8x8x20)
C3-S-46a	493	31	18.5	12,629	10,659	663,000	6	60	
C3-S-76a	522	31	18.6	11,150	10,396	603,000	6	75	
C3-S-A1	492	29	16.5	12,343	7,950	672,000	5	30	
C3-S-A3	473	28	16.5	9,644	7,052	497,000	7	25	
C3-S-A4	492	29	16.5	12,005	7,924	536,000	5	30	
C3-S-A5	492	29	16.5	11,766	7,909	477,000	5	30	
C3-S-BH1	492	29	16.7	12,550	7,854	643,000	5	50	
C3-S-BH2	492	29	16.7	12,031	7,971	607,000	5	50	
C4									
C4-S-57a	561	32	21	13,535	11,105	572,000	6	70	
C4-S-58a	572	31	20	12,728	11,309	630,000	7	60	
C4-S-60a	551	31	21	12,763	10,484	577,000	6	75	
C4-S-64a	544	32	21	13,264	11,202	504,000	6	70	
C4-S-65a	560	30	20	12,699	9,322	480,000	7	80	
C4-S-66a	540	32	20	13,808	10,954	750,000	6	80	
C4-S-1a	564	30	20	13,498	9,214	736,000	7	60	
C4-S-1u	565	32	20	14,349	12,693	673,000	6	60	
C4-S-A4	523	33	17	14,714	10,684	629,000	7	50	
C4-S-B5	520	33	17	15,371	10,780	712,000	7	50	
C5									
C5-S-73b	610	31.6	20	14,600		975,840			928
C5-S-75a	605	35	20.8	22,208	15,949	1,018,000	7	70	409
C5-S-78a	601	34	23.6	15,694	11,757	1,194,000	7	70	800
C5-S-77	583	30	16.0	20,020	15,461	841,000			
C6									
C6-S-1w	661	30	20	16,590	11,100	1,047,000			
C7									
C7-S-68	701	32	22.5	20,574	18,876	1,335,000	10		1,210
C8									
C8-S-81a	820	35	22.5	18,850	26,400	1,125,000	6	446	356 (+49 lighters)
C8-S-81b	820	35	22.5	18,850	26,400	1,125,000	6	446	344 (+49 lighters)
C8-S-82a	874	20	20	27,050	20,500	1,520,000			1,600

**AVERAGE DESIGN CHARACTERISTICS OF REPRESENTATIVE
MARITIME ADMINISTRATION DRY CARGO VESSELS (Continued)**

Design	Length overall (LOA) (ft)	Draft loaded (ft)	Speed (knots)	Deadweight tonnage (Lton)	Gross tonnage	Average bale capacity (cu ft)	No. holds	Heavy lift capacity (Ston)	No. containers (8x8x20)
OTHER									
RORO									
USNS									
COMET	499	27	18	10,545	12,750				
Callaghan	694	29	25	13,500	24,471	1,968,000	6	240	
Heavy-lift									
Seatrain									
Puerto Rico									
(Ex-T-2)	560	27	16.6	12,249	7,991	793,000	1	100	
Trans-									
Colorado									
(Ex-C-4)	523	32	17	11,475	10,014	601,000	5	240	
Multi-									
purpose									
dry cargo									
ships									
(Tentative)	650	28	21.6	29,958 (Total Displacement)		2,015,000		210	1,044

CHARACTERISTICS AND CAPABILITIES OF ARMY LIGHTERS

	LCM(8)	<u>LCU (1466 Class)</u>		LARC XV	LARC LX	BC 7005	BC 231A	BK 7001
		Main	Forward					
Cargo space (inches)								
Length	513	624	264	288	459	1,200	1,320	948
Width	174	354	172	120	164	312	324	240
Height	80	54	—	38	74	—	—	—
Allowable cargo load (long tons)	53.5	150.1	—	13.3	53.5	570.0	585.0	130
Number of CONEX (single tier)								
Type I	20	56	—	10	18	96	102	54
Type II	10	24	—	4	8	48	51	27
Number of palletized load (single tier—stevedore pallets)	21	56	—	12	18	100	108	65



23

24

25

26



27

28

29

30

31

32

33

34



APPENDIX H WARNING LABELS

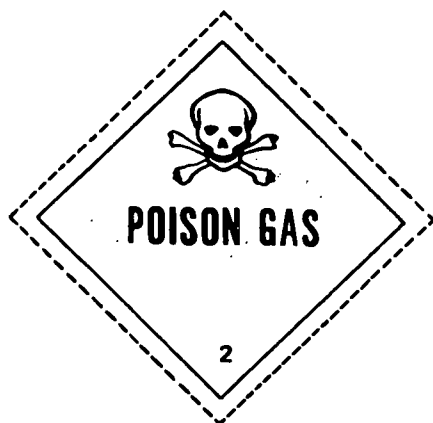
EXPLOSIVES



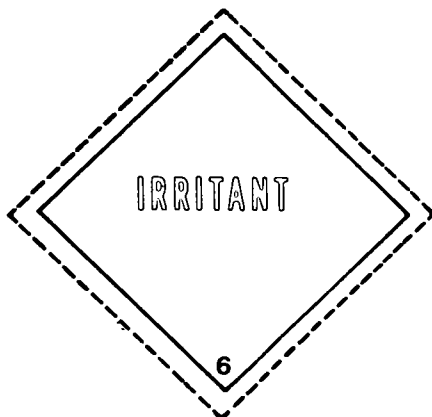
FLAMMABLE LIQUIDS AND SOLIDS



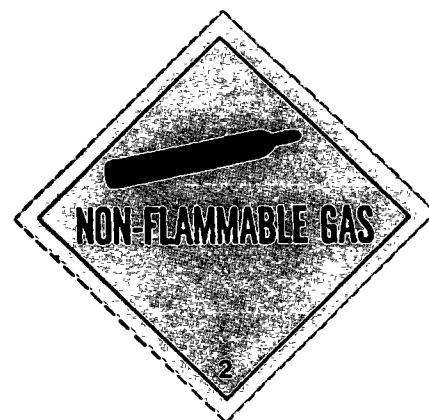
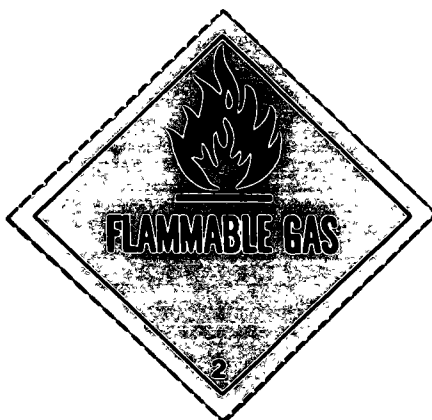
POISONOUS MATERIALS



IRRITATING MATERIAL



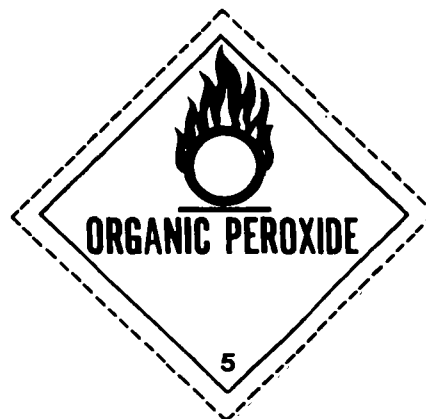
COMPRESSED GASES



RADIOACTIVE MATERIALS

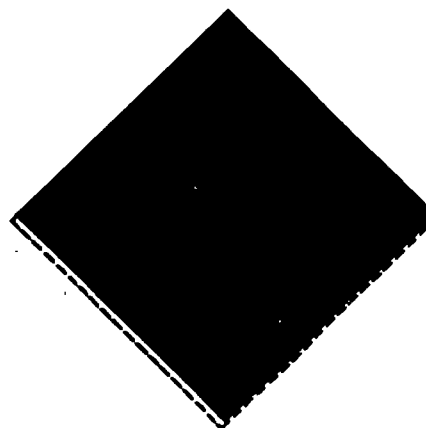


OXIDIZING MATERIALS



SPONTANEOUSLY COMBUSTIBLE MATERIAL

WATER-REACTIVE MATERIAL



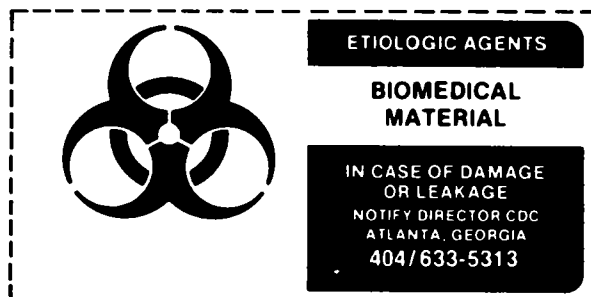
CORROSIVE MATERIAL



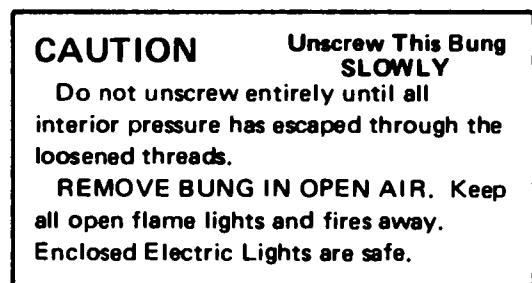
EMPTY



ETIOLOGIC AGENT*



BUNG*



*DISEASE CAUSING CHEMICALS OR ORGANISMS

*USED TO RELIEVE INTERIOR PRESSURE IN PRESSURIZED CONTAINERS

INDEX

A

Address Markings 9-1 thru 9-5
 Administrative Loading 1-5

B

Barges 10-5
 Breakbulk 9-18, 9-19
 Bridge Plates and Ramp 10-3
 Bridles 2-9
 Bulling Cargo 10-18

C

Cargo Booms, Types
 West Coast Rig 4-15
 Wing and Wing Rig 4-15
 Yard and Stay 4-13 thru 4-15
 Cargo Handling Aids 2-12, 2-13
 Cargo Hold Compartment 5-1 thru 5-3
 Cargo Tallying Methods 9-15 thru 9-17
 Cargo Security 5-28, 5-29
 Chains 4-1
 Containerized Cargo
 Handling Equipment 7-1 thru 7-4
 Lifting Containers 7-9 thru 7-11
 Marshalling Yard 9-20
 Safety 10-18
 Security Containers 7-8
 Stuffing Containers 7-6, 7-7
 Stuffing/Stripping 9-21
 Tallying 9-20, 9-21
 Combat Loading 1-5

D

Damage and Loss of Cargo ... 5-26, 5-27
 Discharging Cargo
 Cargo From Holds 5-25
 Deck Cargo 5-24, 5-25, 10-5
 Draglines 5-19, 5-20
 Dunnage 5-10 thru 5-12

F

Formulas
 Alloy Chain 2-5
 Manila Rope 2-3, 10-9
 Shackles 10-13
 Wire Rope 2-4, 10-10, 10-11
 Wrought Chain 2-5, 10-12

G

Gangway 10-1, 10-2
 Gear
 General Purpose Cargo 2-1 thru 2-6
 Special Purpose Cargo 2-6 thru 2-11
 General Working Conditions .. 10-20 thru 10-22
 Guys and Preventers 4-11 thru 4-13

H

Harbor Facilities
 Anchorage 1-1
 Apron 1-1
 Berth 1-1
 Pier 1-1
 Quay 1-1
 Slip 1-1
 Transit Sheds 1-1
 Wharf 1-1
 Hatch Covers 10-4, 10-5
 Hatch Tents 4-27, 4-28
 Hazardous Cargo
 Ammunition Stowage 6-3
 Approved Construction
 Techniques 6-26 thru 6-29
 Bulkhead 6-17, 6-18
 Chemical Stowage 6-3
 Decking 6-9
 Deck Stow Security 6-24 thru 6-26
 Dunnage 6-13 thru 6-16
 Encasement 6-18 thru 6-20
 General Loading
 Procedures 6-1, 6-2
 General Stowage
 Procedures 6-5 thru 6-8
 General Type Explosive
 Loads 6-4

Magazine Stowage	6-3, 6-21
Marking	9-6 thru 9-8
Open Hold Guardrails	6-24
Portable Magazine	6-4
Pyrotechnic Stowage	6-4
Safety	10-19
Special Stowage	6-4
Stepping Down a Load	6-23
Tomming	6-22, 6-23
Heavy Lifts	
Heavy Cases	5-19
Small Boats	5-24
Hacked Vehicles	5-18, 5-24
Wheeled Vehicles	5-18, 5-19, 5-23
Hooks	
Box	2-11
Cargo	10-7
Chime or Drum	2-11
Grab	2-10
Liverpool	2-10
Seattle	2-10
Slip	2-10

J

Jacob's Ladder	10-2
----------------------	------

L

LASH and SEABEE

Block Stow	8-10
Blocking and Bracing	8-12 thru 8-16
LASH	8-6
Modified Block Stow	8-11, 8-12
Preload Operation	8-7
Staggered Block Stow	8-10, 8-11
Stow Plan	8-7 thru 8-9
Tomming	8-17
Logistics-Over-the-Shore	
Operations (LOTS)	8-1 thru 8-5

M

Material Handling (MHE)

Cranes	3-5, 3-6, 4-30, 4-31, 7-2 thru 7-4, 10-16, 10-17
Forklift, Types	3-1 thru 3-3

Pallet Jacks	3-4
Tractors, Trailers, Handtrucks	3-3, 3-4
Military Shipment Label, DD Form 1387, 1387-19, 1387-20	9-1 thru 9-5
Military Shipping Tag, DD Form 1387-1, 1387-1-19, 1387-1-20	9-1 thru 9-5
MILSTAMP Requirements	9-2, 9-6, 9-9, 9-10, 9-12 thru 9-14, 9-19

N

Nets, Cargo	2-6
-------------------	-----

O

Opening and Closing	
Hatches	5-4 thru 5-8, 10-3, 10-5

P

Pallets	2-7, 10-14
Pie Plates	2-6
Plate Handling Clamps	2-11

R

Rain Tents	10-14
Refrigerated Cargo	5-20, 5-21
Rigs and Rigging	
Ebel Rig	4-29, 4-30
Farrel Rig	4-29
Heavy Lifts	4-16 thru 4-22
Jumbo Booms	4-22 thru 4-27
Lowering Booms	4-13
Multiple Topping Lift	4-9, 4-10
Single Topping Lift	4-11
ROLL-ON/ROLL-OFF	8-17 thru 8-19

S

Safety	2-13, 5-8
Safety in Terminal Operations	10-1 thru 10-22

Safe Working Loads	4-16
Save-All Nets	4-28
Securing Cargo	5-9 thru 5-13
Shipboard Terminology	1-6, 5-1
Ship Cargo Handling Gear and Equipment	
Block and Tackle	4-2
Cargo Winches	4-6, 4-7
Chains	4-1
Cranes	4-30, 4-31
Deck Fittings	4-6
Running Rigging	4-4, 4-5
Shackles	4-2
Standing Rigging Gear	4-3
Signals	4-7, 4-8, 4-24 thru 4-27
Slings	
Bomb	6-2
Canvas	2-6
Chain	2-2, 2-4
Combination	2-3
Endless	2-1
Safety	10-17
Single	2-2
Special Marking	9-5 thru 9-8
Spreaders	2-8
Straight Ladder	10-2
Stowing Cargo	
Bagged	5-14
Baled	5-15
Cardboard	5-15
Cases	5-15, 5-22
Crates	5-16
Decks Cargo	5-22
Drums	5-16
General Rules	5-8
Lumber	5-16
Palletized	5-21, 5-22
Piles	5-17
Steel Plates	5-17

T

Terminal Transfer Company	
Assignment	11-2
Mission	11-1
Organization	11-1
Tools	10-14

Transportation Control and Movement Document TCMD (DD Form 1348)	9-8 thru 9-15
--	---------------

V

Vehicles	10-15, 10-16
Vessels	
Classification	1-2
Types	1-2 thru 1-4
Vessel Access	10-1 thru 10-3
Vessel Working Service	10-4, 10-5

W

Winches	10-7
Wire Rope	2-9
Work Force Organization	
Military and Civilian	7-4, 7-5

3000021255

FM 55-17

18 JULY 1979

By Order of the Secretary of the Army:

E. C. MEYER
General, United States Army
Chief of Staff

Official:

J. C. PENNINGTON
Major General, United States Army
The Adjutant General

DISTRIBUTION:

Active Army, USAR and ARNG: To be distributed in accordance with DA Form 12-11 B, Requirements for Army Terminal Operations (Qty rqr block no 398).

Additional copies can be requisitioned from the US Army Adjutant General Publications Center, 2800 Eastern Boulevard, Baltimore, MD 21220.



51

52

53

54



55

56

57

58

59

60







DEPARTMENT OF THE ARMY
US Army AG Publ Center
2800 Eastern Blvd.
Baltimore, Maryland 21220
OFFICIAL BUSINESS
PENALTY FOR PRIVATE USE, \$300

POSTAGE AND FEES PAID
DEPARTMENT OF THE ARMY
DOD314
SPECIAL FOURTH
CLASS BOOK RATE

LIBRARIAN
ARMY LIBRARY PENTAGON
ATTN ANRAI-RS
WASHINGTON
DC 20310
D0774

DA PUBLICATION/FORM NUMBER PUB FM 55-17				RON DATE	
LOCATION	QUANTITY 2	SPECIAL ACTION INIT. DIST.		LINE NO	
TAGO FORM 426 9 OCT 75				BAGPC CONTROL NO 79257-00746	